PART I

LEAN ESSENTIALS

1

Lean Dilemma: Choose System Principles or Management Accounting Controls—Not Both

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1.1 LEAN CURE: SYMPTOM VERSUS ROOT CAUSE

Businesses everywhere have given enormous attention to "lean" management programs for over a decade. However, none emulates what Toyota, the creator of "lean," has achieved. To be sure, many businesses temporarily improve their performance, some greatly, by adopting Toyota practices. But none succeeds as Toyota has at continuously improving lead time, cost, productivity, quality, and overall financial performance year after year after year, for decades.

Failure to reach a desired goal despite repeated attempts often reflects a systemic pattern of problem solving in which people ameliorate symptoms of a problem without removing the problem's root cause. Because they find relief from its symptoms, if only for a while, businesses postpone looking for the problem's deeper root causes. The problem persists and continues to produce troubling symptoms that one temporary fix after another merely alleviates, without ever eradicating the core problem. Does this mode of problem solving characterize most "lean" initiatives? If it does, then such initiatives fit the popular definition of insanity: "doing the same thing over and over again while hoping for different results."

All businesses desire high and stable profitability, period after period for as long as possible. That surely is the goal of most performance improvement programs, including "lean" initiatives. However, such programs invariably boost profitability for only a while, followed by increasing instability and reduced performance until the cycle repeats and management once again rolls out another improvement program that boosts profitability for a while, followed by another disappointing downturn that leads to yet another improvement program, and so on. As a consequence of such improvement-initiative cycles, average results over the long term move in the opposite direction of the desired result, despite brief periods of improvement in the short run.

1.2 BUSINESS RESULTS: MECHANISM VERSUS LIFE SYSTEM

I believe this unintended consequence of improvement initiatives occurs in most businesses because management's view of what causes business results differs greatly from how the business system itself naturally produces those results. In virtually all businesses today, and for the past 50 years or more, management actions meant to improve financial performance reflect a mechanistic view of what causes financial results. In that view, financial results are a linear, additive sum of independent contributions from different parts of the business. In other words, managers believe that reducing an operation's annual cost by $1 million simply requires them to manipulate parts of the business that generate spending in the amount of $1 million each year, say by reducing employee compensation or payments to suppliers. Because managers assume that all parts of their operations make independent contributions to overall financial performance, like the parts of a machine, they would consider any or all of the following steps to be equally effective: lay off employees whose annual pay equals $1 million; reduce wages, salaries, or benefit payments by that amount; force suppliers to accept reduced prices for their goods or services; and outsource employment or contract purchases to less developed countries. It does not matter what steps are chosen, as long as they eliminate $1 million of annual spending.

Were managers to assume, however, that the financial performance of business operations results from a pattern of relationships among a community of interrelated parts, and is not merely the sum of individual contributions from a collection of independent parts, their approach to reducing costs could be entirely different. In that case, managers might attempt to reduce costs by im-

proving the system of relationships that determines how the business consumes resources to meet customer requirements. This would suggest that they view "improvement" primarily in terms of a system of relationships—the human social system that is the business—and not simply in terms of an arithmetic sum of separate parts. More specifically, this would imply that they define and "measure" continuous improvement in terms of a long-term vision of how work should be conducted to best satisfy customer needs with the least consumption of resources. Viewing current operations through the lens of this vision would enable everyone in the organization to see the direction that change must take to move operations closer to that vision.

This is how managers might act if they viewed the operations of a business as part of a natural living system. As I have noted many times in the past two decades, it is not uncommon for scientists today to view human social systems, such as business organizations, as examples of self-organizing and self-identifying living systems.[1] However, such thinking has not yet influenced business education and practice. Indeed, the thinking and behavior of almost all managers in today's business world reflect a worldview grounded in the whole-equals-sum-of-parts and win-lose competitive principles of nineteenth-century mechanics and eighteenth-century classical physics, not the systemic, cooperative, and win-win symbiotic principles of twenty-first century cosmology and life science. In short, today's managers and business educators typically view the financial performance of a business as the sum of independent contributions from separate parts of a machine, not as the emergent outcome from complex interactions among the interrelated parts of a life system. That explains, I believe, why virtually all improvement initiatives, including so-called lean initiatives, inevitably generate long-run financial results that fall far short of what was intended by the initiatives' designers.

It all has to do with a "confusion of levels," a phrase writers often use to describe what the twentieth-century systems thinker Gregory Bateson called a type of epistemological error, an error in the nature of an organization's knowledge, its presuppositions and foundations, and its extent and validity. Bateson said that humans in any culture share certain premises about epistemology, that is, premises "about the nature of knowing and the nature of the universe in which we live and how we know about it."[2] Many of these premises, because they work at some levels and under certain circumstances, are misapplied to other levels. Problems occur when this happens.

People in Western cultures have premises for explaining or understanding the world at two main levels, referred to briefly above. At one level, call it the

mechanical, all events are explained by the influence of external force or impact on independent objects. At the other level, call it the living, all events are explained by patterns of relationships connecting a world of self-organizing beings. The premises at the first level have been successfully used for nearly two centuries to study mechanical processes and to promote engineering technology. They are the basis for scientific and business education and practice in the Western world today. But problems have grown increasingly severe from the erroneous application of these premises to human practices with nature and in social organizations, such as businesses, that as networks of human relationship embody principles of living systems. For example, viewing reality through the premises of the mechanical level, a management accountant in modern business views a spreadsheet of financial results *as the company*. Oblivious to premises at the living level due to the embedded values of the business educational system and the professional organizations that promote these values, this person fails to see the system of human relationships that produces those financial results as the company. As a consequence, the person promotes policies to "improve financial results" by arbitrarily destroying relationships through layoffs or outsourcing, not by nurturing and reinforcing the features of those relationships that produce robust results. The long-term outcome, predictably, is less than expected.

1.3 CONFUSION OF LEVELS: LEAN PRACTICES VERSUS TOYOTA RESULTS

In their customary way of doing things in business, managers confuse linear cause-effect connections at the abstract quantitative level of financial results with the nonlinear, complex cause-effect connections that naturally exist at the concrete level of relationships among employees, suppliers, customers, owners, and community. Their business training and experience cause managers to believe that linear cause-effect connections at the abstract quantitative level apply everywhere in the world, including the level of real operations. Thus, they proceed to manipulate and control people and things at the complex and nonlinear operating level as though they behaved according to the linear principles that apply at the abstract quantitative level.

Therein lies what I refer to as a "confusion of levels"—failure to see that whereas in a mechanical system one-dimensional quantities can both *describe* results and *enable one to control* the linear process that produces those results,

in a living system quantities can *only describe* results, but ***cannot*** *explain or enable one to control* the multidimensional interactions and feedback loops of the process that produces the results. As I discuss in more detail below, this "confusion of levels" invalidates all management accounting practices in which traditional businesses attempt to use financial quantities to explain and to control financial results. Those practices, which are endemic to American management but are not evident at Toyota, are the main reason why lean initiatives fail to have their desired impact on financial performance in American business.

An example of the damaging impact of this confusion is in a case I describe elsewhere that compares the financial (and other quantitative) results in two automobile bumper-making plants.[3] One is run by an American "Big Three" automaker whose managers continually manipulate separate parts of the plant's operations and arbitrarily increase output in order to achieve unit cost targets defined by an abstract financial cost equation. The other is run by Toyota, whose managers focus on nurturing systemic relationships in the plant according to a constant vision that has guided all operations in the company for many decades. The case demonstrates that the lowest cost and highest overall performance are achieved by Toyota, the company that does not confuse linear cause-effect connections at the abstract level of financial cost equations with the complex cause-effect connections at the concrete operating level of human relationships.

I believe it is because lean initiatives do not change the underlying mechanistic thinking that has guided management decisions in virtually all American businesses for the past half century or more that those initiatives fail to achieve results for American companies like the results observed at Toyota. Lean initiatives in non-Toyota companies invariably fail to embody the unique way of thinking about business and the fundamentally different approach to management in which Toyota's practices evolved. Thus, businesses transplant Toyota practices into a context of alien thinking that overpowers and dilutes the effectiveness of those practices. As a consequence, such companies can demonstrate Toyota-style management practices, but not Toyota performance results.

1.4 MANAGEMENT ACCOUNTING CONTROL SYSTEMS BLOCK LEAN

The prevalence of management accounting control systems in American business probably contributes more than any single thing to the confusion of levels

that causes American managers to believe they can run operations mechanically by chasing financial targets, not by nurturing and improving the underlying system of human relationships from which such results emerge. It is significant, then, to note that where this confusion of levels is not present, as in Toyota, one sees virtually no use of management accounting targets (or "levers") to control or motivate operations. I argue that this is an important reason why Toyota's financial performance is unsurpassed in its industry.

People at Toyota place great importance in problem solving on *genchi genbutsu*, or "going to the place" where the problem occurs to see for yourself, firsthand. You don't rely on secondhand reports or tables and charts of data to get true understanding of root cause. Instead, you go to the place (*gemba*) where you can watch, observe, and "ask why five times." This attitude reflects, of course, no "confusion of levels." Instead, it shows a deep appreciation that results (and problems) ultimately emanate from and are explained by complex processes and concrete relationships, not by abstract quantitative relationships that describe results in simple, linear, additive terms.

It should not be surprising, then, to realize that managers in a Toyota plant, unlike their counterparts in American organizations, do not refer to accounting documents such as standard cost variance budgets to discuss the state of current operations. Indeed, as I was told in 1992 during my first of scores of trips to Toyota's Georgetown, Kentucky plant, Toyota views daily plant operations as a "black box" that the accounting system essentially does not enter.[4] Accountants, of course, record everything that goes into the plant and all the products that come out. But within the plant they don't track the flow between incoming resources and outgoing finished product. Everything one needs to know about the transformation that takes place inside the plant is inherent in the flow of the work itself. Indeed, a key feature of the Toyota Production System (TPS) is that the work itself provides the information needed to control its state. In other words, all the information needed to control operations is in the work.

Professor Kazuhiro Mishina introduced me to this aspect of the TPS in 1992, when he showed me a high-level "material and information flow map" for the Georgetown plant. He explained that the map is designed to show *material* flowing from left (raw material) to right (finished autos) and *information* flowing from right to left. Basically, there was only one line going from right to left—a line to represent the customers' orders entering the plant each day and going directly to the body welding operation.[5] Today, this type of map is familiar to anyone who has studied "value-stream mapping." But Kazuhiro pointed out to me that no lines representing information enter the plant from

either the accounting system or the production control system. The work itself provides all the information that in non-Toyota plants customarily comes from computerized manufacturing resource planning (MRP) and standard cost variance reports.

While the value-stream mapping literature does an excellent job of showing how the TPS dispenses with the need for production controls (e.g., MRP) in daily operations, it is silent on how TPS also dispenses with the need for accounting controls in daily operations. This is an unfortunate lapse, in my opinion, because it has left the door open to the idea that "lean" manufacturing programs must include "lean" accounting controls, something that Toyota people, especially the late Taiichi Ohno, often referred to as *muda* (waste).

In Toyota plants, all information needed to control operations is in the work simply because all work flows continuously at a balanced rate through virtually every operation, from the beginning to the end of the manufacturing process. The work has been carefully designed so that one can "see" its current state quite literally. Is it on time to meet the day's orders? If not, how much additional time will be needed? Have defects or other errors occurred along the way? Are components to final assembly being replenished on a timely basis? Has any undue inventory accumulated anywhere? Are problems being identified and addressed according to standard procedures? Such questions, and hundreds more, can be answered every moment in every step of the process throughout the plant. No accounting system can alert managers as well or as fast if anticipated costs and revenues will not be achieved. Any "exceptions" that managers might need to address to keep financial results on track are visible in real time as the work is being done, not days, weeks, or months later in a report from the accounting department.

1.5 LEAN ACCOUNTING ANSWERS THE WRONG QUESTION

If traditional management accounting practices are the key problem preventing American businesses from emulating Toyota's performance, what should companies do? Many proponents of lean accounting suggest that companies should reform management accounting itself by doing things such as activity-based value-stream costing, direct costing, cash-flow accounting, value-add capacity analysis, and more. These proposals should cause a sense of *deja vu* among those who are old enough to recall some 20 years ago the proposals to

gain better control over burgeoning overhead costs with activity-based cost (ABC) information. ABC seemed like a good idea at the time, but in retrospect it was a good answer to the wrong question. We see better today, when we understand more fully what Toyota does, that reducing manufacturing overhead costs requires a new way to organize work, not better cost information. The question that proponents of ABC should have been asking was how to organize work to eliminate the causes of overhead activity, not how to trace costs of overhead activities to products in more discriminating ways. Perhaps now is the time for companies interested in becoming "lean" to reframe the question that management accounting control systems are supposed to answer. It is time to recognize that management accounting controls are a good answer to a wrong question; that if the question were properly reframed, management accounting controls probably would not be a valid answer.

The question most companies ask now is how to control the financial results of business operations if financial results are a linear sum of individual contributions from separate parts of the business. Accounting control information seems the logical way to show how those contributions, and changes in those contributions, add up to the organization's overall financial results. But if we assume that financial results emerge from complex interactions and nonlinear feedback loops in the interrelated parts of a natural living system, then attempting to control those results with linear accounting information is not only erroneous, but possibly destructive to the system's operations in the long run. In this case, the new question is: how does one control, if at all, the financial results that emerge from operations that abide by the principles that govern a natural living system?

1.6 ANSWERS TO THE RIGHT QUESTION—FROM SHEWHART AND DEMING TO TOYOTA

An early answer to this question was provided in the 1930s and 1940s by Walter Shewhart and W. Edwards Deming, both trained in mathematical physics and both experienced in using state-of-the-art statistical tools in business and government. One of their lasting contributions was to devise a scientific way to estimate the "control limits" within which a business system's results would almost always fall until one of two steps were taken that altered the limits. One step was to ignore all but abnormal variation in results and work to improve the system itself, thereby narrowing the control limits and improving long-

term performance. The other step, a less desirable but more common way of managing, was to try to improve long-term performance by intervening in the system every time results varied from a desired target. The inevitable consequence of the second step, Shewhart and Deming proved, is to widen the system's control limits and impair its long-term performance.[6]

In essence, Shewhart and Deming likened a well-designed business system to a living system in nature. Its results vary over time, but the range of variation has limits. However, in a human system such as the operations of a business, managers can improve performance by taking steps to reduce that range of variation. The key to performance improvement, then, is to nurture the system that produces results, not to drive the system to achieve targets that fall outside its normal performance limits. In his early work, Deming articulated 14 principles (or points) that defined what he meant by nurturing the system. Those principles included things such as create constancy of purpose, constantly improve systems by reducing variation, cease dependence on inspection, do not base purchases on price alone, do not reward individual performance, institute training, eliminate management by objectives, and more.

This is precisely the approach that Toyota takes to manage its operations. Toyota lives by a set of deep underlying system principles that, after observing their system on many study missions to their plants in the 1990s, I tried to sum up in my own words with the concept "managing by means." As I outlined it in my book *Profit Beyond Measure* (New York: Free Press, 2000), the essence of that concept, which compares Toyota's system to a living system, is that satisfactory business results follow from nurturing the company's system (the "means"), not from manipulating and wrenching its processes in order to achieve predetermined financial results (a mechanistic strategy popularly known as "managing by results").[7] In his own recent and excellent synthesis of Toyota's system principles, Jeffrey Liker articulates the same concept in his book *The Toyota Way* (New York: McGraw-Hill, 2003) with the phrase "creating the right process will produce the right results."[8]

This sentiment is central to the Toyota organization's deep-seated belief that one cannot improve financial performance by intervening in the system and forcing operations people to achieve results targets. Instead, they emphasize the importance of defining the properties their operating system should manifest and of having everyone in the organization work assiduously to continuously move the system toward those properties. Frequently, one hears Toyota people refer to those properties as "True North." True North in Toyota's system includes properties such as safety (for employees and for customers), moving

work always in a continuous flow, one order at a time on time, with no defects, with all steps adding value, and with the lowest consumption of resources possible. The assumption is that the more that every process in the system manifests the properties of True North, the better will be the company's long-term performance.

These three approaches to managing operations—the Shewhart-Deming approach, managing by means (MBM), and the Toyota way—suggest how different it is to nurture the system that produces a company's financial results than it is to arbitrarily intervene in and wrench the system in an attempt to force it to produce a desired result beyond its current capabilities. The latter strategy is, of course, followed by virtually all large companies in the United States today, especially the large publicly traded companies whose top managers are pressured to deliver results demanded by financial markets and other outside interests. It seems unbelievable, but many of those companies are pursuing lean initiatives in the expectation of achieving performance like Toyota's. The fact that they will not or cannot forego pressure to drive operations with management accounting "levers of control" makes the likelihood of their realizing such expectations nearly zero.

1.7 MANAGEMENT ACCOUNTING CONTROLS OR SYSTEM PRINCIPLES: PICK ONE, NOT BOTH

If managers look primarily at financial information to judge the performance of a business, then they are certain to be working in the dark, unless I am mistaken and the operations they manage do in fact behave according to mechanistic principles. But anyone who is aware of modern life science can never again view a human social organization, such as a business, as anything but a natural living system. That being the case, it stands to reason that the key to favorable long-term financial performance is to design and run operations according to the principles that guide living systems. Such principles resemble Deming's, 14 points, the principles of managing by means (MBM), and those that Toyota refers to today as The Toyota Way or True North. Only if a company can describe its operating system in terms of such principles can it know whether or not the system is improving.

Financial quantities cannot reveal if a system is improving or not. To assume otherwise is to fall prey to "confusion of levels." If a company requires cost information to show the "savings" from "going lean," it is lost and will

never get there. Requiring cost information to justify taking the steps that are necessary to become lean discourages people from continuously removing sources of delay and error that stand in the way of moving closer to achieving system principles such as those underlying living systems or Toyota's True North. Instead, they will create work-arounds such as rework loops, forks, and inventory to keep work moving (even if it is not continuously flowing) in the hope of eliminating unfavorable unit cost variances. In other words, the demand to justify operational decisions with cost information confuses levels, causing people to forego root-cause problem solving and, instead, to build "cost-effective" work-arounds that violate system principles. Eventually, the system principles are forgotten and managers spend increasing amounts of time working to improve the efficiency of the work-arounds.

No company that talks about improving performance can know what it is doing if its primary window on results is financial information and not system principles. No amount of financial manipulation will ever improve long-term results. Performance in the long run will improve only if managers ensure that the system from which the performance emerges adheres more and more closely to principles resembling those that guide the operations of a living system. The dilemma facing all companies that intend to become "lean" is that they can follow a truly systemic path to lean or they can continue to use management accounting "levers of control." They can't do both.

1.8 EPILOGUE: LEAN AND THE QUESTION OF SUSTAINABILITY

Management accounting controls impose a curse on lean management programs; they cause managers to believe that addressing the imperative of growth is compatible with the possibility of systemic well-being.[9] Abstract quantities by themselves can, of course, grow without limit. However, the universe has never allowed any real, concrete system within it to grow endlessly. Such attempts to grow endlessly inevitably fail. Had it been otherwise the universe by now would be only one thing—the system that never stopped growing until it became everything, and nothing.

Nevertheless, all businesses that chase accounting targets for revenue, cost, profit, or return on investment somehow believe they are an exception to this universal pattern. They "confuse levels" and are deaf to the primordial message being delivered every time their real operations fail to deliver the long-term

performance that their abstract equations and their occasionally favorable short-term returns seem to promise. They fail to see that the pursuit of endless growth is incompatible with the long-term survival of the system.

This message applies to the entire human economy as well as to individual businesses in the economy. Even if every company in the world were to become as "lean" as Toyota, today's economy in which they operate is not sustainable. Forces drive it to focus on quantitative goals, hence, on extensive growth. Government tax, spending, and monetary policies promote more and more production and consumption, to grow gross domestic product (GDP) endlessly. Financial markets drive companies, including Toyota, to play in the same game. But an economy that lives on steroids is no more sustainable than any growth-driven organization operating within it. Until they can escape the curse of endless growth, both the economy and all its members are doomed to collapse and die.

Our Earth and its life-sustaining biosystem, as well as all systems in the entire universe from which Earth emerged, reflect the existence of continuously open fields of possibility. The most fundamental and most pervasive process in the universe, and especially on our Earth, is the constant emergence of newness out of what went before. Nothing ever constrained the flourishing of possibility in that process until humans introduced the idea of quantitative choice to the system. Quantity automatically limits possibility and emergence to outcomes that can be measured. Quantum physicists have suggested that undisturbed systems in the universe naturally stay in multiple states simultaneously, unless someone intervenes with a measurement device. Then all states except the one being measured collapse. Perhaps what you measure is what you get. More likely, what you measure is *all* you get. What you don't (or can't) measure is lost.

By using quantitative targets to manage results without regard to the effect our actions have on the underlying system from which the results emerge we close fields of possibility and limit ourselves to what our measures will produce. In effect, that describes existence inside a machine, not life. Life implies flourishing in fields of continuously renewing possibility. Mechanistic existence suggests a repetitive, homogeneous system running down to death, without hope of renewal or new possibility. Our worship of quantity virtually guarantees that the economy we inhabit today and the businesses within it are life-denying, not life-enhancing.

Businesses, like any living systems, should grow to be what they are supposed to be, not more. Ants grow to be ants, elephants grow to be elephants, and

humans grow to be humans. Each in its context flourishes in life, in being—not in growing, accumulating, or having. Sustainability, as my colleague John Ehrenfeld has said, is *the possibility that humans and other life flourish on the Earth forever*.[10] Nurturing that possibility is the challenge that companies, citizens and the communities we inhabit must accept in the name of sustainability. "Lean" management in the sense of running companies according to living system principles is an important first step in meeting this challenge. Then comes the hard part: conducting our economic activities within the limits of Earth's regenerative processes. To fail at that will make all the lean initiatives irrelevant. But we can succeed, as long as we choose to live according to the principles of living systems and not according to the imperative of quantitative growth.

NOTES

1. H. Thomas Johnson, "Using Performance Measurement to Improve Results: A Life-System Perspective," *International Journal of Strategic Cost Management*, Vol. 1, No. 1 (Summer 1998), pp. 1–6; H. Thomas Johnson and Anders Broms, *Profit Beyond Measure: Extraordinary Results through Attention to Work and People* (New York: Free Press, 2000), pp. ix–xvi, 1–9, and 33–42; Fritjof Capra, *The Hidden Connections: A Science for Sustainable Living* (New York: Doubleday, 2002), Ch. 4; Elisabet Sahtouris, "The Biology of Business: New Laws of Nature Reveal a Better Way for Business," *World Business Academy Perspectives*, Part 1 in Vol. 19, No. 3 (September 15, 2005) and Part II in Vol. 19, No. 4 (September 22, 2005).
2. Gregory Bateson, *Steps to an Ecology of Mind* (New York: Ballantine Books, 1972), p. 478.
3. H. Thomas Johnson, "Lean Accounting: To Become Lean, Shed Accounting," *Cost Management*, January/February 2006, pp. 3–17.
4. H. Thomas Johnson and Anders Broms, *Profit Beyond Measure: Extraordinary Results through Attention to Work and People* (New York: Free Press, 2000), pp. 103–110.
5. See note 4, p. 82, Figure 3-1 for a version of the material and information flow map.
6. A succinct and excellent introduction to Deming's (and Shewhart's) thinking, including applications of statistical process control tools, is in Brian L. Joiner and Marie A. Gaudard, "Variation, Management, and W. Edwards Deming," *Quality Progress*, December 1990, pp. 29–37.
7. See note 4.

8. Jeffrey K. Liker, *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer* (New York: McGraw-Hill, 2004), Section II.
9. H. Thomas Johnson, "Confronting the Tyranny of Management by Numbers: How Business Can Deliver the Results We Care About Most," *Reflections: The SoL Journal on Knowledge, Learning, and Change*, Vol. 5 Compilation (2004), No. 4, pp. 51–61; "Sustainability and Lean Operations," *Cost Management*, March/April 2006, pp. 40–45.
10. John Ehrenfeld, "Searching for Sustainability: No Quick Fix," *Reflections: The SoL Journal on Knowledge, Learning, and Change*, Vol. 5 Compilation (2004), No. 8, pp. 137–149; "Beyond Sustainability: Why an All-Consuming Campaign to Reduce Unsustainability Fails," 2006, http://www.changethis.com/25.03.BeyondSustain.