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Learning to Manage Complexity

November 7, 2005

Jonathan Byrnes (HBS DBA '80) writes The Bottom Line, a monthly column that details innovative methods for increasing profit from an existing business without costly new initiatives.

by Jonathan Byrnes

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"Success often hurts, and even mortally wounds, well-run small businesses."

With these words, the late Daryl Wyckoff described what he called the "Bermuda Triangle of motor carrier profitability." In his landmark book *Organizational Formality and Performance in the Motor Carrier Industry*, Wyckoff described a rather strange profitability pattern of trucking companies. Both small and large companies were very profitable, but the medium-sized companies were quite unprofitable.

Wyckoff found that small trucking companies that were run by strong entrepreneurs, often hands-on managers, did well and grew. They continued to grow and prosper as long as the entrepreneur could see what was happening in the whole company and directly control all the activities. The problem was that as these small successful trucking companies grew, they typically established a network of terminal facilities. At some point, the complexity of this network prevented the entrepreneur from being able to know and personally manage the whole system.

Some entrepreneurs figured out that they would have to manage their companies in a different way. They hired strong terminal managers, delegated authority, and managed through planning-and-control systems. These entrepreneurs were able to continue growing their companies and wound up having very profitable large companies.

Other entrepreneurs, however, couldn't let go. They tried to continue managing their growing companies as they always had. Costs went out of control, and profitability plunged. They had to retrench, and once again they found themselves managing small trucking companies. Because they were strong entrepreneurs and the companies were small again, they were able to regain control of their companies. They once again made their companies prosper and grow, up to the point where they lost control, lost profitability, and had to retrench yet again. And so the cycle continued, causing the "Bermuda Triangle" Wyckoff described.

In later work, Wyckoff and others found the same pattern in the restaurant industry, the hotel industry, and other similar businesses.

The problem was complexity, not revenues. It turns out that complexity causes businesses to change in fundamental ways. There are businesses that grow to billions of dollars of revenues before this problem hits. These companies have a fairly simple, controllable business model, and they can pump more and more business through it. But when they begin opening multiple factories or distribution centers, or sourcing abroad, all of a sudden the world changes. Most often, their internal systems and customary way of managing have to change completely. Their managers don't know what hit them.

Changing states

Many familiar processes are capable of "changing states." Think about what happens when you slowly turn on a water faucet. At first, a small stream comes out. This stream is very well defined and almost looks like a cylinder. As you open the faucet more and more, the stream becomes wider and stronger. At some point, however, the stream loses its coherence and water splatters all over the sink. The laminar flow turns into turbulent flow. In a sense, the water changes states, much like the small trucking company that opened one

too many terminals.

When a distribution center approaches capacity, it changes in fundamental ways.

Visualize the strong entrepreneur in a small trucking company. At a certain point, the company seems to change state. All of a sudden, it requires a new way of managing. To the entrepreneur who doesn't understand what's happening, it seems that he or she will have to manage the unmanageable, and everything that worked in the past no longer works. In fact, the company has suddenly become "something else," a new state. Often, the business has actually drifted into complexity without management being aware that things have changed, and awareness may have been triggered by a major crisis of some kind. The solution is to manage in a different way.

Think about driving on a crowded highway. Suddenly, the traffic slows to a near stop, then starts again, then slows again, all for no apparent reason. In highway engineering, these are called shock waves. They occur when the traffic load approaches highway capacity. At this point, the highway "changes states," and rapidly loses its effective capacity.

In distribution, managers sometimes encounter "full-warehouse syndrome." When a distribution center approaches capacity, it changes in fundamental ways. After a certain point, it becomes very difficult to find things and to maneuver around the facility. Cushions of time, space, labor, and communication that are critical to smooth operations become too small as activity approaches capacity. Just like the highway, the warehouse's effective capacity plunges rapidly.

Most business processes, and associated costs, have this two-state nature. They behave more or less as expected up to a point; then they explode. In the former state, they are controllable with ordinary business measures; in the latter, they look unmanageable using familiar techniques. Nearly all cost models ignore this fact. Generally, the key management action is to analyze where the state changes, causing costs to explode, and to find ways to keep the throughput below this point, or to figure out a way to manage the new state.

The resilient enterprise

In a very important new book, *The Resilient Enterprise*, Yossi Sheffi analyzes how to manage the unmanageable. Sheffi reports on his extensive study about supply chain disruptions. Some of these disruptions are so serious that they can cause a company to "change states," threatening its ability to survive and requiring fundamentally different management techniques.

Sheffi's book, like Wyckoff's, shows that through careful, insightful analysis and research, the seemingly unmanageable can indeed be understood. Armed with this understanding, managers can tame and manage seemingly impossible situations.

In the wake of Hurricane Katrina, a *Wall Street Journal* report was particularly relevant and remarkable: It described how Wal-Mart had executed a well-conceived disaster plan and had positioned the right product in the right stores, even as the hurricane advanced on the U.S. Gulf Coast. Wal-Mart succeeded because it figured out what to do in a probable and understood new state before that state occurred. *The Resilient Enterprise* explains how companies can attain this level of capability; the explanation is presented very clearly and illustrated by numerous anecdotes and concrete examples.

Supply chain disruptions come in many forms. Some people may think of natural disasters like Hurricane Katrina, and others of terrorist acts like 9/11. But these are only the tip of the iceberg. Factory fires, supply shortages, product contamination, and a host of other problems can cause disruptions that can and likely will endanger nearly every company. Traditional management techniques are no more effective in these situations than small company management techniques are for the large, complex trucking company.

Sheffi says it is useful to think about disruptive events using a 2x2 matrix: Along one axis is the likelihood of the event occurring, and along the other is the severity of the consequences. By this logic, disruptions can range from fairly frequent small-impact events, like a delivery being late, to infrequent high-impact situations, like a major product recall. In different situations, different management approaches are needed.

The manager who wants to develop an effective program to minimize the impact of supply chain disruptions will find three major areas of management initiatives described in Sheffi's book.

First, the manager should focus carefully on understanding the company's supply chain vulnerabilities. This includes analyzing the types of disruptions that can occur, assessing their likelihood, and estimating their probable effects. Managers need to know what the new states look like before they can design techniques, processes, and systems to manage them.

Second, with this understanding the manager can create a concrete program to reduce the company's vulnerability. Ways to do this range from reducing the likelihood of intentional disruptions, to intercompany and private-public collaboration for security, to systematic detection of disruptions, to resilience through redundancy.

Managers must build a measure of supply chain flexibility into their companies through process and structural changes.

Third, while vulnerability reduction creates important potential benefits, it is not enough. Managers must

build a measure of supply chain flexibility into their companies through process and structural changes. They can achieve this through interchangeability of parts and production facilities, through postponement, which customizes the product late in the production process, through flexible supply, and through customer relations management. These elements are critical because they allow a company to improve its resilience without simply adding costly inventory and capacity.

In a particularly important chapter, Sheffi explains the overwhelming importance of culture. He compares Dell, UPS, and a U.S. Navy aircraft carrier, all organizations that are very well attuned to their surroundings, and very resilient. He identifies six key shared cultural traits: (1) continuous communications among informed employees; (2) deference to expertise; (3) distributed power, which allows employees to take timely action; (4) knowledgeable, experienced management involved with the operations; (5) passionate employees who can be entrusted with the power to act; and (6) organizations conditioned to be innovative and flexible through frequent and continuous "small" challenges.

Sheffi underscores the importance of company culture. "Company culture may be the real secret to the business success of the companies discussed in this book. . . . Day in and day out, this culture allows them to respond quickly and effectively to fluctuations in demand, small supply disruptions, and manufacturing woes."

In other words, managers every day have the opportunity to practice on a small scale the key elements that will be needed to anticipate and manage the infrequent large-scale disruptions that make the evening news. The key management factors that prepare a company for managing the unmanageable are in fact the same ones that provide excellence in the day-to-day business, whether it is a company coordinating to meet its everyday supply chain disruptions or a trucking entrepreneur learning to delegate authority before the critical need arises.

Ultimately, this insight may be the most important contribution of Yossi Sheffi's valuable, timely book.

See you next month. wK

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