SYSTEMS ARCHETYPES II

Using Systems Archetypes to

Take Effective Action

PEGASUS
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➤ BY DANIEL H. KIM

THE TOOLBOX REPRINT SERIES

Systems Archetypes I: Diagnosing Systemic Issues and Designing High-Leverage Interventions

Systems Archetypes II: Using Systems Archetypes to Take Effective Action

Systems Archetypes III: Understanding Patterns of Behavior and Delay

Systems Thinking Tools: A User's Reference Guide

The "Thinking" in Systems Thinking: Seven Essential Skills

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A *fast-growth company suddenly experiences a sharp decline in sales, even as it doubles its marketing efforts. . . . Unbeknownst to its management, quality standards at one company's manufacturing plants gradually slip lower and lower—until a product malfunction creates a companywide crisis. . . . In its struggles to keep its customers happy and remain competitive, a company expedites more and more orders—pleasing some people but creating product line disruptions that seem to get it even more off track. . . .* These stories are examples of systems archetypes in action—recurring patterns of behavior that crop up in a variety of settings. The archetypes consist of different combinations of reinforcing and balancing loops, and when applied to business problems, can yield insight into the structure at work and reveal possible high-leverage interventions.

The Systems Archetypes Series (part of the Toolbox Reprint Series) was compiled from *THE SYSTEMS THINKER* newsletter and is intended as an in-depth guide to the structure and use of the archetypes. *Systems Archetypes I* introduces the basic structure and storyline of each of the archetypes, along with general guidelines for how they can be applied to specific organizational issues. *Systems Archetypes II* goes further into applications, providing a step-by-step process for using each of the archetypes in a particular setting or context. More than just a "how-to" guide, it provides a grounded approach to problem diagnosis and intervention that can enable more effective action. Finally, *Systems Archetypes III* takes a deeper look at the "signature" patterns of each archetype.

Organizations can use the archetypes to become more effective at tackling complex issues in at least three different ways. First, the archetypes can be used as diagnostic tools for developing an understanding of a current situation. Second, as planning tools, they can help us anticipate future consequences and plan for them. Third, the archetypes can be used as theory-building tools to help build a growing body of knowledge about our understanding of the world.

AS DIAGNOSTIC TOOLS

The archetypes provide a systemic structure and storyline that we can use to "diagnose" or make sense of a particular situation. By developing a deeper understanding of how we came to be in the current "mess," we are able to identify the fundamental forces that brought us there and then point to ways to resolve the current situation and avoid repeating such errors in the future. Articles that show how the archetypes can be used as a diagnostic tool include:
- Using "Fixes That Fail" to Get off the Problem-Solving Treadmill (p. 14)
- Using "Shifting the Burden" to Break Organizational Gridlock (p. 20)
- Using "Tragedy of the Commons" to Link Local Action to Global Outcomes (p. 24)

AS PLANNING TOOLS

Rather than just diagnosing a problem after the fact, some of the archetypes can also be used more proactively as planning tools. By looking ahead at the systemic consequences of proposed actions, we can identify structures that may impede our progress and then plan for them in advance. Using the archetypes in this way can help potential problems to surface long before they happen and provide a window of opportunity to intervene when we have the most leverage for taking effective action. Examples include:
- Using "Growth and Underinvestment" for Capital Planning (p. 16)
- Using "Limits to Success" as a Planning Tool (p. 18)

AS THEORY-BUILDING TOOLS

It is often said that there is nothing more useful than a good theory. Theory helps us to make sense of the world, and enables us to apply that understanding beyond the specifics of an individual case. The challenge for an organization, therefore, is to become its own best theory-builder. Using the archetypes to build organizational theory can lead to a fundamental rethinking of the organization's structure, role, and purpose. Examples of using archetypes to map an organization's "worldview"—how it views itself and its role in the larger environment—include:

- Using "Drifting Goals" to Keep Your Eye on the Vision (p. 10)
- Using "Escalation" to Change the Competitive Game (p. 12)
- Using "Success to the Successful" to Avoid Competency Traps (p. 22)

Each article in this booklet offers a seven-step process for applying the particular archetype to a specific business situation. But neither the seven steps nor the three ways of using the archetypes are meant to be the definitive word on "correct" usage. They are simply offered as a useful framework for beginning to work with the archetypes.

The systems archetypes are essentially an exploratory tool that can help us see things that we may not otherwise see—whether it be from a diagnostic, planning, or theory-building perspective. As you work with these tools, you may find a need to deviate from the outlined steps or create new ones. Working with the archetypes in this way is key in such a creative process, as there are probably thousands of different ways to use the systems archetypes to take more effective action.

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P.S. We'd love to hear of your experiences as you apply the archetypes to your own business issues. Send a note to us at editorial@pegasuscom.com.

THE LANGUAGE OF LINKS AND LOOPS

s → A causal link between two variables,
+ → where a change in X causes a change in Y in the same direction, or where X adds to Y.

o → A causal link between two variables,
− → where a change in X causes a change in Y in the opposite direction, or where X subtracts from Y.

R   A "reinforcing" feedback loop that amplifies change.

B   A "balancing" feedback loop that seeks equilibrium.

BALANCING LOOP EXAMPLE

If there is a gap between the desired level and the actual level, adjustments are made until the actual equals the desired level. The starting variable is grey.

THE LANGUAGE OF ACCUMULATORS

"clouds" represent the boundaries of what we want to include in the diagram

LEVELS OF UNDERSTANDING: "FIRE-FIGHTING" AT MULTIPLE LEVELS

It's another busy night in the hospital emergency room. Several car accident victims have been rushed into surgery, one 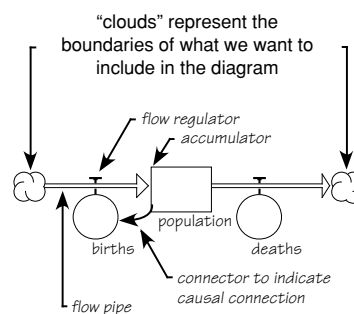little boy is having a broken arm set, a drug overdose victim is being treated, and numerous other people fill the chairs in the waiting room. Each night is different, and yet each one is also the same. The doctors and nurses must act fast to treat the most seriously injured, while the others wait their turn. Like an assembly line of defective parts, patients are diagnosed, treated, and released. Each injury is a crisis that demands immediate attention.

So what's wrong with this picture? After all, isn't this what emergency rooms are meant to do? The answer depends on the level of understanding at which we are looking at the situation.

LEVELS OF UNDERSTANDING

There are multiple levels from which we can view and understand the world. From a systemic perspective, we are interested in four distinct levels—events, patterns of events, sys-temic structure, and shared vision (see "Levels of Understanding"). Events are the things we encounter on a day-to-day basis: a machine breaks, it rains, we eat dinner, see a movie, or write a report. Patterns of events are the accumulated memories of events—when strung together in a series over time, they reveal recurring patterns. Systemic structure can be viewed as "event generators" because they are responsible for producing the events. Similarly, shared vision can be viewed as "systemic structure generators" because they are the guiding force behind the creation or change of all kinds of structures.

We live in an event-oriented world, and our language is rooted at the level of events. At work, we encounter a series of events, which often appear in the form of problems that we must "solve." Our solutions, however, may be short-lived, and the symptoms can eventually return as seemingly new problems (see "Using 'Fixes That Fail' to Get off the Problem-Solving Treadmill," p. 14). This is consistent with our evolutionary history, which was geared toward responding to those things that posed an immediate danger to our well-being.
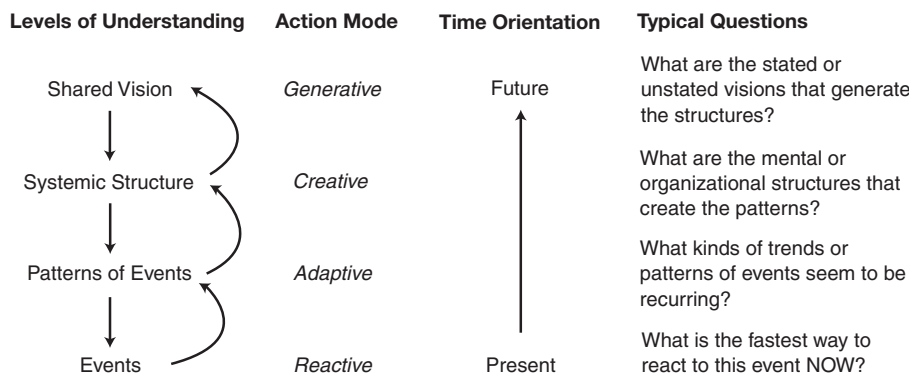
Events require an immediate response. If a house is burning, we react by taking action to put out the fire. Putting out the fire is appropriate, but if it is the only action that is ever taken, it is inadequate from a systemic perspective. Why? Although it solved the immediate problem (the burning house), it has done nothing to alter the fundamental structure that caused that event (e.g., inadequate building codes, lack of fire detectors, fire prevention education). The "Levels of Understanding" diagram and framework can help us go beyond typical event-orientation responses and begin to look for higher leverage actions.

FROM FIRE-FIGHTING TO FIRE PREVENTION

At the event level, if a house is on fire, all we can do is react as quickly as possible to put the fire out. The only mode of action that is appropriate and available is to be reactive. If we reacted to fires only at the events level, we would put all of our energy into fighting fires—and we would probably have a lot more fire stations than we do today.

If we look at the problem of fires at the pattern of events level, we can begin to anticipate where they are more likely to occur. We may notice that certain neighborhoods seem to have more fires than others. We are able to be adaptive by locating more fire stations in those areas, and staffing them accordingly (based on past patterns of usage). Since the stations are a lot closer, we can be more effective at putting out fires by getting to them

LEVELS OF UNDERSTANDING

Levels of Understanding	Action Mode	Time Orientation	Typical Questions
Shared Vision	Generative	Future	What are the stated or unstated visions that generate the structures?
Systemic Structure	Creative		What are the mental or organizational structures that create the patterns?
Patterns of Events	Adaptive		What kinds of trends or patterns of events seem to be recurring?
Events	Reactive	Present	What is the fastest way to react to this event NOW?

sooner. Yet while being adaptive allows us to be more effective fire-fighters, it does nothing to reduce the actual occurrence of fires.

At the systemic structure level we begin asking questions: "Are smoke detectors being used? What kinds of building materials are less flammable? What safety features reduce fatalities?" Actions taken at this level can actually reduce the number and severity of fires. Establishing fire codes with requirements such as automatic sprinkler systems, fireproof materials, fire walls, and fire alarm systems saves lives by preventing or containing fires. Actions taken at this level are creative because they help create a different future.

Systemic structure includes not only the organizational structures and physical buildings, but people's mental models and habits as well. Where do the systemic structures come from? They are usually a reflection of a shared vision of what is valued or desired. In the case of fire-fighting, the new structures (e.g., fire codes) are born out of a shared value of the importance of protecting human lives, combined with the desire to live and work in safe buildings. At the level of shared vision, our actions can be generative, bringing something into being that did not exist before. We begin asking questions like "What's the role of the fire-fighting function in this community? What are the trade-offs we are willing to make as a community between the amount of resources devoted to fire-fighting compared to other things?"

It is important to remember that the process of gaining deeper understanding is not a linear one. Our understanding of a situation at one level can feed back and inform our awareness at another level. Events and patterns of events, for example, can cause us to change systemic structures and can also challenge our shared vision. To be most effective, the full range of levels must be considered simultaneously. The danger lies in operating at any one level to the exclusion of the others.

Our ability to influence the future does increase, however, as we move from the level of events to shared vision. Does this mean that high-leverage actions can only be found at higher levels? No, because leverage is a relative concept, not an absolute. When someone is bleeding, the highest leverage action at that moment is to stop the bleeding—any other action would be inappropriate. As we move up the levels from events to shared vision, the focus moves from being present-oriented to being future-oriented. Consequently, the actions we take at the higher levels have more impact on future outcomes, not present events.

BACK AT THE EMERGENCY ROOM

While the emergency room (ER) offers a graphic example of a situation in which people must be focused on the present, it also reveals the limitations of the events-oriented response. ER treatment offers maximal leverage to affect the present situation with each patient, but it provides very little leverage for changing the future. If we go up one level and examine ER use from a patterns of events level, we may discover that certain areas of a city seem to have higher emergency room needs. We may try an adaptive response and increase ER capacity in those regions. If diversion rates are high, we can also find out where the ambulances are being diverted from and try to enhance capacity there.

At the systemic structure level, we can begin to explore why certain regions have an increased need for ERs. We may discover, for example, that 40 percent of the ER admissions are children who are poisoned, because a large percentage of the community cannot read English and all warning labels are printed in English. By redrawing the boundary of the ER issue to include the community, we can take actions that will change the inflow of patients. Electrical utilities have been doing this for some time. Instead of building another expensive power plant to supply more power, they are working with customers to reduce the demand for power.

At a community-wide level, we may want to explore the question, "What is our shared vision of the role our healthcare system plays in our lives?" Perhaps the resources that are going into ERs could be better utilized elsewhere, such as community education and prevention programs. The highest leverage lies in clarifying the quality of life we envision for ourselves, and then using that as a guide for creating the systemic structures that will help us achieve that vision.

The basic message of the "Levels of Understanding" diagram is the importance of recognizing the level at which you are operating, and evaluating whether or not it provides the highest leverage for that situation. Each level offers different opportunities for high-leverage action, but they also have their limits. The challenge is to choose the appropriate response for the immediate situation and find ways to alter the future occurrence of those events. ◘

A PALETTE OF SYSTEMS THINKING TOOLS

There is a full array of systems thinking tools that you can think of in the same way as a painter views colors—many shades can be created out of three primary colors, but having a full range of ready-made colors makes painting much easier.

There are at least 10 distinct types of systems thinking tools. They fall under four broad categories: brainstorming tools, dynamic thinking tools, structural thinking tools, and computer-based tools. Although each of the tools is designed to stand alone, they also build upon one another and can be used in combination to achieve deeper insights into dynamic behavior.

BRAINSTORMING TOOLS

The Double-Q (QQ) Diagram is based on what is commonly known as a fishbone or cause-and-effect diagram. The Qs stand for *qualitative* and *quantitative*, and the technique is designed to help participants begin to see the whole system. During a structured brainstorming session with the QQ diagram, both sides of an issue remain equally visible and properly balanced, avoiding a "top-heavy" perspective. The diagram also provides a visual map of the key factors involved. Once those factors are pinpointed, Behavior Over Time Diagrams and/or Causal Loop Diagrams can be used to explore how they interact.

A QQ diagram begins with a heavy horizontal arrow that points to the issue being addressed. Major "hard" (quantitative) factors branch off along the top and "soft" (qualitative) factors run along the bottom. Arrows leading off of the major factors represent sub-factors, which can in turn have *sub* sub-factors. Many layers of nesting, however, may be a sign that one of the sub-factors should be turned into a major factor.

DYNAMIC THINKING TOOLS

Behavior Over Time (BOT) Diagrams are more than simple line projections—they capture the dynamic relationships among variables. For example, say we were trying to project the relationship between sales, inventory, and production. If sales jump 20 percent, production cannot jump instantaneously to the new sales number. In addition, inventory must drop below its previous level while production catches up with sales. By sketching out the behavior of different variables on the same graph, we can gain a more explicit understanding of how these variables interrelate.

Causal Loop Diagrams (CLDs) provide a useful way to represent dynamic interrelationships. CLDs make explicit one's understanding of a system's structure, provide a visual representation to help communicate that understanding, and capture complex systems in a succinct form. CLDs can be combined with BOTs to form structure-behavior pairs, which provide a rich framework for describing complex dynamic phenomena. CLDs are the systems thinker's equivalent of the painter's primary colors.

Systems Archetypes is the name given to certain common dynamics that seem to recur in many different settings. These archetypes, consisting of various combinations of balancing and reinforcing loops, are the systems thinker's "paint-by-numbers" set—users can take real-world examples and fit them into the appropriate archetype. They serve as a starting point from which one can build a clearer articulation of a business story or issue. Specific archetypes include: "Drifting Goals," "Shifting the Burden," "Limits to Success," "Success to the Successful," "Fixes That Fail," "Tragedy of the Commons," "Growth and Underinvestment," and "Escalation" (see "A Pocket Guide to Using the Archetypes," p. 8).

STRUCTURAL THINKING TOOLS

Graphical Function Diagrams, Structure-Behavior Pairs, and *Policy Structure Diagrams* can be viewed as the building blocks for computer models. Graphical Functions are useful for clarifying non-linear relationships between variables. They are particularly helpful for quantifying the effects of variables that are difficult to measure, such as morale or time pressure. Structure-Behavior Pairs link a specific structure with its corresponding behavior. Policy Structure Diagrams represent the processes that drive policies. In a sense, when we use these tools we are moving from painting on canvas to sculpting three-dimensional figures.

COMPUTER-BASED TOOLS

This class of tools, including computer models, management flight simulators, and learning laboratories, demands the highest level of technical proficiency to create. On the other hand, very little advance training is required to use them once they are developed. ◻

Systems Thinking Tools: A User's Reference Guide, part of the Toolbox Reprint Series, is organized around this palette of systems thinking tools.
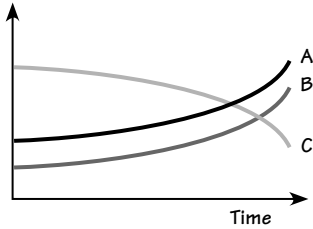
| DYNAMIC THINKING TOOLS	STRUCTURAL THINKING TOOLS	COMPUTER-BASED TOOLS

Behavior Over Time Diagram

Can be used to graph the behavior of variables over time and gain insights into any interrelationships between them. (BOT diagrams are also known as reference mode diagrams.)
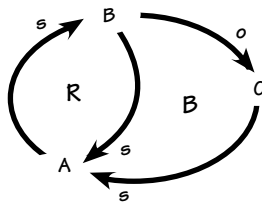
Graphical Function Diagram

Captures the way in which one variable affects another, by plotting the relationship between the two over the full range of relevant values.
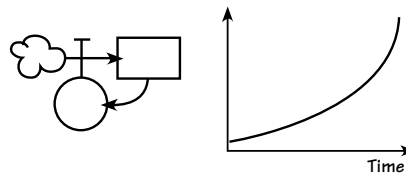
Computer Model
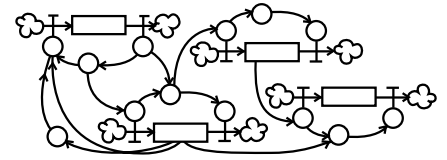
Lets you translate all relationships identified as relevant into mathematical equations. You can then run policy analyses through multiple simulations.

Causal Loop Diagram

Used in conjunction with behavior over time diagrams, can help you identify reinforcing (R) and balancing (B) processes.

Structure-Behavior Pair

Consists of the basic dynamic structures that can serve as building blocks for developing computer models (for example, exponential growth, delays, smooths, S-shaped growth, oscillations, and so on).

Management Flight Simulator
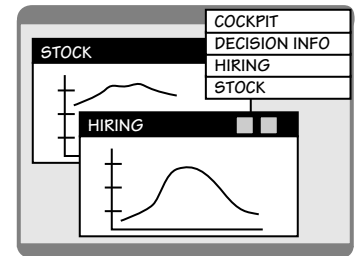
Provides "flight training" for managers through the use of interactive computer games based on a computer model. Users can recognize long-term consequences of decisions by formulating strategies and making decisions based on those strategies.

Systems Archetype
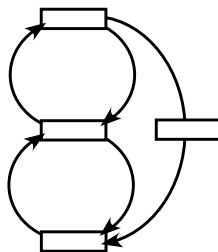
Helps you recognize common system behavior patterns such as "Drifting Goals," "Shifting the Burden," "Limits to Success," "Fixes That Fail," and so on—all the compelling, recurring "stories" of organizational dynamics.

Policy Structure Diagram
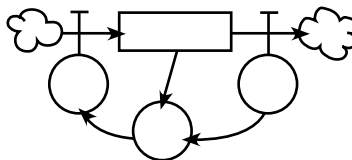
A conceptual map of the decision-making process embedded in the organization. Focuses on the factors that are weighed for each decision, and can be used to build a library of generic structures.

Learning Laboratory
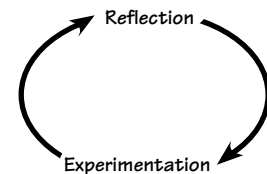
A manager's practice field. Is equivalent to a sports team's experience, which blends active experimentation with reflection and discussion. Uses all the systems thinking tools, from behavior over time diagrams to MFSs.

A POCKET GUIDE TO USING THE ARCHETYPES

ARCHETYPE-APPLICATION	INTERVENTION GUIDELINES	ILLUSTRATION
DRIFTING GOALS **Application:** *Staying Focused on Vision* Various pressures can often take our attention away from what we are trying to achieve. The "Drifting Goals" archetype helps explain why an organization is not able to achieve its desired goals. Used as a diagnostic tool, it can target drifting performance areas and help organizations attain their visions (see p. 10).	1. Identify drifting performance measure. 2. Look for goals that conflict with the stated goal. 3. Identify standard procedures for closing the gap. Are they inadvertently contributing to the goal slippage? 4. Examine the past history of the goal. Have the goals themselves been lowered over time? 5. Anchor the goal to an external reference. 6. Clarify a compelling vision that will involve everyone. 7. Create a clear transition plan. Explore what it will take to achieve the vision, and establish a realistic time-line.	**Drifting Quality Standards**
ESCALATION **Application:** *Competition* One of the reasons we get caught in escalation dynamics may stem from our view of competition. The "Escalation" archetype suggests that cutthroat competition serves no one well in the long run. The archetype provides a way to identify escalation structures at work and shows how to break out of them or avoid them altogether (see p. 12).	1. Identify the competitive variable. Is a single variable the basis of differentiation between competitors? 2. Name the key players caught in the dynamic. 3. Map what is being threatened. Are your company's actions addressing the real threat, or simply preserving core values that may no longer be relevant? 4. Reevaluate competitive measure. Can the variable that is the foundation of the game (price, quality, etc.) be shifted? 5. Quantify significant delays that may be distorting the nature of the threat. 6. Identify a larger goal encompassing both parties' goals. 7. Avoid future "Escalation" traps by creating a system of collaborative competition.	**Escalating Frequent Flyer Promotions**
FIXES THAT FAIL **Application:** *Problem-Solving* Almost any decision carries long-term and short-term consequences, and the two are often diametrically opposed. The "Fixes That Fail" archetype can help you get off the problem-solving treadmill by identifying fixes that may be doing more harm than good (see p. 14).	1. Identify problem symptom. 2. Map current interventions and how they were expected to rectify the problem. 3. Map unintended consequences of the interventions. 4. Identify fundamental causes of the problem. 5. Find connections between both sets of loops. Are the fixes and the fundamental causes linked? 6. Identify high-leverage interventions. Add or break links in the diagram to create structural interventions. 7. Map potential side-effects for each intervention in order to be prepared for them (or to avoid them altogether).	**Fixes for Falling Sales**
GROWTH AND UNDERINVESTMENT **Application:** *Capital Planning* If demand outstrips capacity, performance can suffer and hurt demand. If this dynamic is not recognized, the decrease in demand can then be used as a reason not to invest in the needed capacity. "Growth and Underinvestment" can be used to ensure that investment decisions are viewed from a fresh perspective, rather than relying on past decisions (see p. 16).	1. Identify interlocked patterns of behavior between capacity investments and performance measures. 2. Identify delays between when performance falls and when additional capacity comes on-line—particularly perceptual delays regarding the need to invest. 3. Quantify and minimize acquisition delays. 4. Identify related capacity shortfalls. Are other parts of the system too sluggish to benefit from added capacity? 5. Fix investment decisions on external signals, not on standards derived from past performance. 6. Avoid self-fulfilling prophecies. Challenge the assumptions that drive capacity investment decisions. 7. Search for diverse investment inputs. Seek new perspectives on products, services, and customer requirements.	**Underinvesting in Service Capacity**

ARCHETYPE-APPLICATION	INTERVENTION GUIDELINES	ILLUSTRATION
Limits to Success Application: *Planning* If we don't plan for limits, we are planning for failure. The "Limits to Success" archetype shows that being successful can be just as dangerous to long-term health as being unsuccessful. By mapping out the growth engines and potential danger points in advance, we can anticipate future problems and eliminate them before they become a threat (see p. 18).	1. Identify the growth engines. 2. Determine doubling time of those processes. 3. Identify potential limits and balancing loop(s)—physical capacity, information systems, personnel, management expertise, attitudes/mental models. 4. Determine change required to deal effectively with the limit(s) identified. 5. Assess time needed to change. Is there a discrepancy between the doubling time and the changes that need to be made to support that growth? 6. Balance the growth. What strategies can be used to balance the growth engine with the time frame of the investments that must be made to sustain it? 7. Reevaluate the growth strategy. Continually challenge assumptions in context of the broader company.	**Technical Support Capacity Limits**
Shifting the Burden Application: *Break Organizational Gridlock* Organizational gridlock can be caused by interlocking "Shifting the Burden" structures, as one function's "solution" creates problems in another area. The archetype provides a starting point for breaking gridlock by identifying chains of problem symptoms and solutions that form walls between functions, departments, or divisions (see p. 20).	1. Identify the original problem symptoms. 2. Map all "quick fixes" that appear to be keeping the problems under control. 3. Identify impact on others. What are the inpacts of those "solutions" on other players in the company? 4. Identify fundamental solutions. Look at the situation from both perspectives to find a systemic solution. 5. Map side-effects of quick fixes that may be undermining the usability of the fundamental solution. 6. Find interconnections to fundamental loops. Find the links between the interaction effects and the fundamental solution that may be creating gridlock. 7. Identify high-leverage actions from both perspectives.	**Interlocking Problems in Car Development Program**
Success to the Successful Application: *Avoid Competency Traps* The "Success to the Successful" archetype suggests that success or failure may be due more to initial conditions than intrinsic merits. It can help organizations challenge their success loops by "unlearning" what they are already good at in order to explore new approaches and alternatives (see p. 22).	1. Investigate historical origins of competencies. 2. Identify potential competency traps. 3. Evaluate current measurement systems—are they set up to favor current systems over other alternatives? 4. Map internal view of market success. What are the operating assumptions around success in the market? 5. Obtain external views of market success. Ask "outsiders" for alternative strategies. 6. Assess effects on the innovative spirit. Is the current system excluding or limiting the spirit of experimentation that will lead to new alternatives? 7. Continually scan for gaps and areas for improvement.	**Success of the "QWERTY" Keyboard**
Tragedy of the Commons Application: *Resource Allocation* In a "Tragedy of the Commons" situation, the complex interaction of individual actions produces an undesirable collective result, such as the depletion of a common resource. The archetype can be used to help connect the long-term effects of individual actions to the collective outcome, and to develop measures for managing the common resource more effectively (see p. 24).	1. Identify the "commons." What is the common resource that is being shared? 2. Determine incentives. What are the reinforcing processes that are driving individual use of the resource? 3. Determine time frame for reaping benefits. 4. Determine time frame for experiencing cumulative effects of the collective action. 5. Make the long-term effects more present. How can the long-term loss or degradation of the commons be more real and present to the individual users? 6. Reevaluate the nature of the commons. Are there other resources or alternatives that can be used to remove the constraint upon the commons? 7. Limit access to resources. Determine a central focal point—a shared vision, measurement system, or final arbiter—that allocates the resource based on the needs of the whole system.	**Overgrazing the Alternator**

USING "DRIFTING GOALS" TO KEEP YOUR EYE ON THE VISION

As a child, did you ever have a contest to see who could build the tallest house out of playing cards? As you crafted your house, your whole body would tense up with the effort of concentrating on carefully balancing each card. You knew exactly what the house should look like, and how you should place the cards to maximize the height. The goal was clear and your method was sure.

But as you placed each card and the house grew taller, you began to worry more about the possibility of the house falling down than about building it. You worried about the air currents being stirred as people walked by; you were careful not to breathe while placing each card. Try as you might, it became harder and harder to concentrate on that perfect card house. The sweat beaded on your brow as your

DRIFTING QUALITY STANDARDS

A gap between actual Tater Tot quality and the quality standard should have signaled the need to invest in production processes or ingredients (B1). But because the drift in quality occurred over a long period of time, it was not perceived as a problem (B2).

shaky hand placed one more card on top, and . . . CRASH!

KEEPING FOCUSED ON WHAT WE WANT

Many goals succumb to the same fate as that house of cards. Try as we might to keep focused on the goal, other pressures interfere and take our attention away from what we are really trying to achieve. Productivity standards, cost control measures, fire-fighting—all can undermine a project or effort and, over time, lead to a "Drifting Goals" scenario. We become focused on what we don't want to have happen, rather than on what we want to change.

The "Drifting Goals" archetype is helpful for trying to understand why an organization is not able to achieve its desired goals. "Drifting Goals" occurs when the gap between a goal and the actual performance is reduced by lowering the goal. As this often happens over a long period of time, the gradual lowering of the goal is usually not apparent until the performance measure has drifted so low that it produces a crisis (see "Drifting Goals: The 'Boiled Frog' Syndrome," October 1990). The following seven-step process illustrates how to use the "Drifting Goals" archetype as a diagnostic tool to target drifting performance areas in an effort to help organizations attain their visions.

1. IDENTIFY PERFORMANCE MEASURE THAT HAS DETERIORATED OR OSCILLATED OVER TIME

Sometimes the actual performance measure that has deteriorated is not the same as the one you have identified. For example, when sales of Tater Tots

fell from 1985 to 1987, managers at Ore-Ida assumed that the decline reflected a change in consumer eating habits. Further exploration, however, showed that the quality of the Tater Tots had gradually declined over the years: "Their once-chunky insides had turned to mashed potato. The outside had lost its light and crispy coating" ("Heinz Ain't Broke, But It's Doing a Lot of Fixing," *Business Week,* December 11, 1989).

At Ore-Ida, the goal was in the form of a quality standard for Tater Tots (see "Drifting Quality Standards"). A gap between actual quality and that goal should have signaled the need for investments in new equipment and/or the quality of the ingredients (B1). But because the drift in the quality standard (B2) occurred over a long period of time, it was not perceived as a problem.

2. IDENTIFY IMPLICIT OR EXPLICIT GOALS THAT ARE IN CONFLICT WITH THE STATED GOAL

Sometimes there are implicit or explicit goals in an organization that are at odds with the stated goal. For example, Ore-Ida was committed to producing quality Tater Tots, but the company had also embarked on a series of cost-control plans beginning in 1979. "Cost-cutting had led plant managers to step up line speeds and change storage and cooking methods. Over a decade, the moves had changed Tater Tots." Identifying other related goals that may be affecting the particular performance measure could reveal conflicts that create sub-optimization.
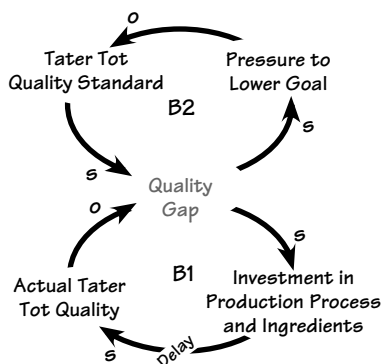
3. WHAT ARE THE STANDARD OPERATING PROCEDURES FOR CORRECTING THE GAP?

Identifying the standard operating procedures (SOPs) for correcting the gaps will give you a window into the kinds of corrective actions that are currently in place. You want to find SOPs that may have inadvertently contributed to the slippage of goals. What has happened that may have caused the corrective actions themselves to erode over time?

4. HAVE THE GOALS THEMSELVES BEEN LOWERED OVER TIME?

A key question is whether the setting of the goals has been linked to past performance. The idea is to have an asymmetric relationship between past performance and future goals. When performance is continually improving, basing the next goal on the previous one can create cycles of continuous improvement. But this strategy can lead to disaster when performance begins to slip, creating a reinforcing cycle of declining quality.

At Ore-Ida, the actual Tater Tot quality and the quality standard were linked together in such a way that as the quality deteriorated, it affected the quality reference point (see "'Slippery Slope' of Quality"). From year to year, the quality looked about the same, even as it was decreasing (R3). One side-effect of sliding quality could be that as sales decrease (due to poor quality), the company might decide to cut back on investments in production process and materials. That would lead to lower quality, which would actually accelerate the deterioration of quality (R4). Breaking this cycle involves creating measures that will counterbalance such tendencies.

5. IDENTIFY EXTERNAL FRAMES OF REFERENCE TO ANCHOR THE GOAL

One way to keep goals from sliding is to anchor them to an external frame of reference. The reference point can't be chosen arbitrarily, or it will be susceptible to change. Benchmarking provides an outside reference point. It won't tell you how to achieve a goal, but it offers a frame of reference and shows what is possible in a given area.

The voice of the customer is the ultimate source, however. At Ore-Ida, customer polls could have given a clear indication that sliding sales were a reflection of declining quality, not a change in consumer preferences.

6. CLARIFY THE VISION

Unless you establish a clear vision that is compelling for everyone involved, the improvement will be only temporary. You can motivate people and train them to use the tools that provide the corrective action, but if they really don't understand what the vision is all about, at best they will only be complying. Over time, the system will slip back into making only the corrective actions that look good relative to what is being measured, regardless of the impact on the company.

7. CREATE A TRANSITION PLAN

After you achieve clarity around the vision, the next step is to explore what it will take to achieve that vision, as well as anticipate the expected time frame. Where are the goals in relation to that transition plan? If you're currently operating at a level of 1 and you're trying to get to 10, it is unrealistic to expect the change to occur overnight.

Unrealistic expectations about the time frame for achieving a goal can produce emotional tension and financial pressure that can undermine even the best improvement program. The question to consider at this point is how to make sure that the gap between current reality and the goal does not turn into a negative force. If we don't carefully manage the effects of emotional tension, we lose the powerful potential of having a vision. In some ways, that is both the biggest challenge and potentially greatest benefit of applying a "Drifting Goals" archetype.

Creative tension only works when somehow it taps into a level of motivation that is intrinsic. That becomes a powerful leverage point for an organization whose creative forces have been tapped by the excitement of achieving the vision. The lesson of the "Drifting Goals" archetype is that in any attempt to achieve a goal or vision, you can't bypass the emotional tension that results. Instead, by channeling that tension into a creative force, you can transcend it and attain the vision. ◘

"SLIPPERY SLOPE" OF QUALITY
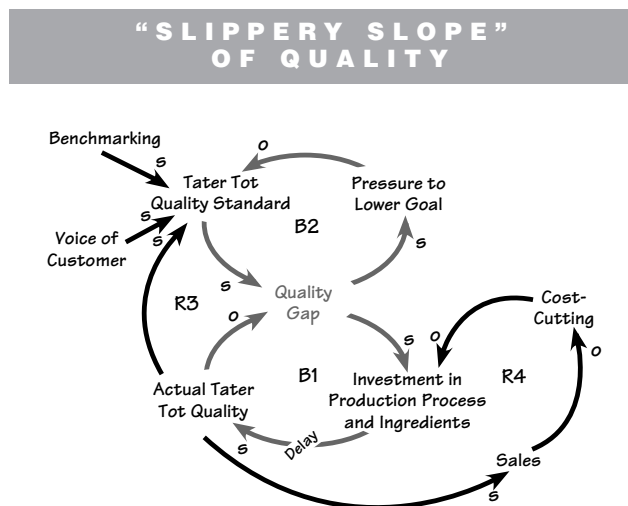
If actual quality and the quality standard are linked together, quality may appear to remain same from year to year even as it decreases (R3). If deteriorating quality results in a decrease in sales, the company may cut back on investments, further accelerating the deterioration (R4).

USING "ESCALATION" TO CHANGE THE COMPETITIVE GAME

You open your latest credit card bill and what do you find? Most likely another promotional offer for frequent flyers: earn bonus miles by staying at the airline's hotel "partner," renting a car from its rental "partner," or charging purchases on a "partner's" credit card. Without ever paying for an actual flight, you can earn free tickets for future trips.

Although these promotions are great for consumers, they may spell trouble for the airlines. All of the promotions are tied up in an escalation dynamic, where each time a new promotion is offered by one airline, others are compelled to match or beat it just to stay competitive. Each round of new promotions begets more promotions. Once a company or industry is caught in this "Escalation" structure, it is hard to stop the dynamics.

"Escalation" begins when one party takes actions that are perceived by another as a threat. The second group responds by taking action that improves its own situation but increases the first group's insecurity. The first group must then increase its activities in order to improve its competitive position relative to the other. The spiraling result of each group trying to retain control can lead to a war in which neither group feels in control (see "Escalation: The Dynamics of Insecurity," November 1991).

There are two main issues that underlie this structure. First, the "Escalation" archetype describes the dynamics of insecurity. The actions of all involved parties create insecurity, compelling one party to attempt to regain control by taking action, which only leads to retaliation by the other. Second, "Escalation" is often a zero-sum game. A price war in a fixed market, for example, means that when Company A wins more customers, Company B loses customers. Losing customers makes Company B insecure about its ability to sustain itself, so it is forced to react with a countermeasure.

If your company, like the airlines, is stuck in an escalation dynamic, what can you do? The following seven steps can help identify "Escalation" structures at work and show how to break out of them or avoid them altogether.

1. IDENTIFY THE COMPETITIVE VARIABLE

Is your company or industry focused on a single variable as a basis of differentiation from competitors? If you have continually taken action in that area—and your efforts have steadily increased over time—you may already be caught in an escalating dynamic. In the airline industry, for example, the frequent flyer program has gone from being merely a promotional technique to becoming a focal point of competition (see "Escalating Frequent Flyer Promotions"). As the market share of one airline drops relative to another, the increasing competitive threat leads it to use frequent flyer promotions to increase loyalty and, hence, ticket sales (B1). But as the first airline's market share grows, airline B (and C and D . . .) must respond with its own promotion to regain market share (B2). All the airlines then become caught in the "Escalation" trap.

2. NAME THE KEY PLAYERS

After having identified the competitive focus, next pinpoint the parties whose actions are perceived as the major sources of threat. Ask yourself, "Who are the dominant players that are caught in the cycle?" The critical players in the airline industry, for example, might be the big three carriers—American, Delta, and United. On the other hand, if you think you may be caught in an "Escalation" structure within your company, are there specific groups within departments—rather than whole departments—that are the key participants?

3. MAP WHAT IS BEING THREATENED

The "Escalation" archetype can be very useful for bringing a company's deep-rooted assumptions and core beliefs to the surface. If, for example, you feel your market share is being challenged, what does that mean for your organization at a deeper level? Does it threaten your reputation as the market leader or

ESCALATING FREQUENT FLYER PROMOTIONS
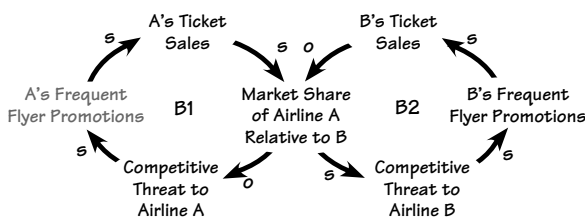
Airline A's frequent flyer promotions increase its ticket sales and market share (B1). But as A's market share grows, airline B (as well as C, D, etc.) must respond with its own promotions to remain competitive (B2). The airlines' actions trace out a figure-8 reinforcing cycle of escalating promotions.

your "no-layoff" track record? You should then examine whether the actions being taken are addressing the actual threat or simply preserving core values that may not be relevant in the new competitive arena.

4. REEVALUATE RELATIVE MEASURE

Part of the "Escalation" archetype trap is that everyone becomes focused on a single competitive variable. Determining the relative measure that pits each party against the other is crucial for breaking the cycle. Can the foundation of the game be shifted so the players are not really in the same game?

When choosing between airlines, travelers tend to focus on price and schedules rather than on service. Promotions have therefore become a primary means for differentiation. The problem with promotions, however, is that they are easily copied and offer no long-term advantage. But if one airline clearly and consistently provided better service and made traveling significantly more enjoyable, people might choose that company because of its great service. SAS Airlines, for example, achieved that with the creation of "Euro Class"—part of its focused strategy to best serve the business traveler.

5. QUANTIFY SIGNIFICANT DELAYS

Delays can distort the true nature of a threat by providing short-term relief while a company or industry's long-run capability is systematically being undermined. The heavy discounting in the airline industry, for example, will carry long-term implications for the industry's viability. In the short term, consumers may hail the benefits of price wars and promotions, but these actions can lead to higher fares and worse service in the long run (see "Decline in Airline Service and Full-Fare Sales"). As promotions become more prevalent, consumers' willingness to pay full fare for tickets

decreases, leading to an industry-wide decrease in sales of full-fare tickets, which decreases each individual airline's ticket sales (R3 and R5). As the number and variety of an airline's promotions increases, emphasis on customer service investments may decrease, which can lead to a decline in sales and to more promotions activity (R4 and R6). The promotions therefore keep the airlines' attention away from the areas it needs to invest in, while the delays in the system camouflage the long-term impact.

6. IDENTIFY A LARGER GOAL

A leverage point in the "Escalation" archetype is to identify an overall objective that can encompass both parties' goals. Once you have identified the larger goals, the next question to ask is whether the system is structured to achieve those goals. Are there ways businesses are participating to ensure that the larger goals will be met? Are there ways to actually expand the market, rather than having to cut up a limited pie? To address these larger issues, some kind of central governing body (not necessarily the government) that can serve the needs of the whole community may be necessary.

For example, as a nation we need to ask, "Why do we need a healthy domestic airline industry in the first place?" If we acknowledge that the viability of the whole industry is important for the nation, then

coordinated actions at an industry level must be identified.

7. LEARN TO AVOID "ESCALATION" TRAPS

The best antidote to the "Escalation" archetype is to avoid getting caught in it in the first place. One of the reasons we get caught in escalation dynamics may stem directly from how our thoughts around competition are structured. In a competition model, there is no room for collaboration; yet the "Escalation" archetype suggests that cut-throat competition serves no one well in the long run.

The "Escalation" archetype can serve as a starting point for exploring ways that collaborative competition can occur. Collaborative competition may serve as the means for bringing out the best in each company (or department) by encouraging it to excel in its own unique way, rather than being an also-ran in a crowded field of look-alikes. ◘

DECLINE IN AIRLINE SERVICE AND FULL-FARE SALES
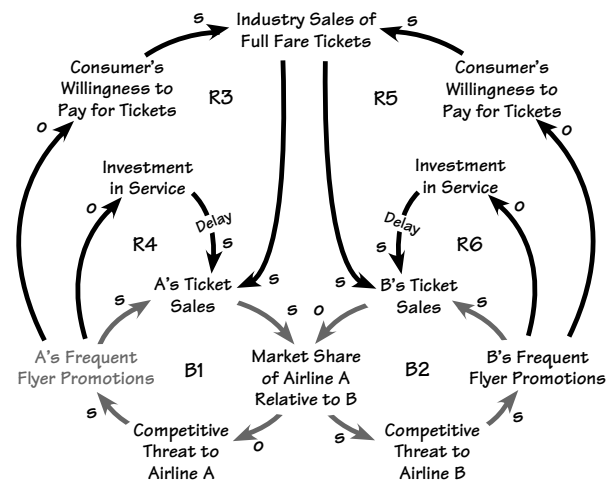
As the number and variety of an airline's promotions increases, the financial pressure that results from these promotions often translates into decreasing customer service investments, which affects ticket sales (R4 and R6). In addition, as promotions become more prevalent, consumers' willingness to pay full fare for tickets decreases, leading to an industry-wide decrease in sales of full-fare tickets, as well as a decrease in an individual airline's ticket sales (R3 and R5).

USING "FIXES THAT FAIL" TO GET OFF THE PROBLEM-SOLVING TREADMILL

It's Monday morning. You've just settled in at your desk to catch up on some reading, when the phone rings. The program manager of the SuperFast Computer is on the other end: the prototype scheduled for tests today is not ready. When you follow up to see what's going on, you discover it is more than just one or two missing parts—almost one-third is not ready!

How did this happen? All your planning schedules seemed up-to-date, and there were no indications of delays. Now each of the departments is blaming the others: "If only they had given me x on time . . . " "If only the packaging group had let me know when they first knew they were falling behind . . .". Now you will have to hassle the different departments to get the parts out as quickly as possible, like you did with the last program. But you thought the problem had been solved—the company made it clear that late parts and missed target dates would not be tolerated. In fact, severe penalties were outlined. What happened?

FIXES FOR FAILING SALES
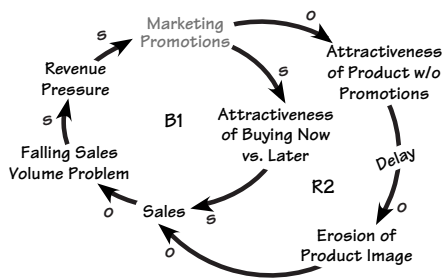
A common "fix" for falling sales volume is marketing promotions (B1). However, that can tarnish the product image, justifying the need for more promotions to prop up sales (R2).

THE PROBLEM-SOLVING TREADMILL

The above scenario is typical for many people caught on a problem-solving treadmill. The "Fixes That Fail" archetype provides a starting point to help you get off the treadmill by identifying "quick fixes" that may be doing more harm than good (see "Fixes That Fail: Oiling the Squeaky Wheel—Again and Again," November 1990). The central theme of this archetype is that almost any decision carries long-term and short-term consequences, and the two are often diametrically opposed.

In the case of the product launch, the fix that was meant to keep everyone on target actually made things worse. Penalizing those who missed deadlines created a dynamic where no one dared reveal that they were running late. If no one was "discovered" before a critical deadline (like a prototype test), then everyone would be discovered at the same time, and no one person or team could be singled out. After that crisis was addressed, schedules would be stressed even more and penalties for failure would be increased . . . again. The result: programs are continually run with inaccurate information, creating rework and further hurting the schedule.

Getting off the problem-solving treadmill starts with becoming aware of how one is operating in such a structure. What follows is a seven-step process for mapping out the systemic consequences of quick fixes and for identifying high-leverage actions.

1. START WITH THE PROBLEM SYMPTOM

We often confuse "problem solutions" with problem symptoms. We are so used to responding to certain types of problems that we begin to see the lack of our solutions as being the problem. Problem solution statements like "The problem is . . . we need a bigger sales force," or "The problem is . . . we don't have the latest order processing system" can lead you right back on to the problem-solving treadmill.

It is important to spend some time up front defining the problem symptom. This will force you to understand the problem as separate from any actions that you have taken, or plan to take. Try turning problem solution statements such as "lack of sales training" into problem symptom phrases like "falling sales volume."

2. MAP CURRENT INTERVENTIONS

After you have clarified the problem, you can map out various past "solutions," as well as current and planned actions. This is where you may include your favorite solutions such as sales training, marketing promotions, advertising campaigns, etc. In each case you want to draw out how the interventions will rectify the problem. For example, marketing promotions make it more attractive to buy now vs. later, which leads to higher sales (loop B1 in "Fixes for Falling Sales" diagram).

By following the discipline of clearly articulating how your actions affect the problem, you create an explicit map of your causal assumptions. The output of this mapping process can be used to show others how you understand the problem, and invite them to add to or modify the

diagram from their point of view.

3. MAP UNINTENDED CONSEQUENCES

One action can produce multiple consequences. People are usually good at recognizing the intended results, but not as good at identifying the unintended consequences. Use the causal diagram to map out potential side-effects of any actions you have taken to rectify the problem.

For example, one danger of repeatedly using marketing promotions to boost sales volume is that the products become less attractive when they are not accompanied by promotions. Over a period of time, product image erodes and sales decline. This exacerbates the sales volume problem, which then justifies the use of more marketing promotions (R2). This tendency of the system to reinforce the need to take the same actions again and again is at the heart of "Fixes That Fail."

4. IDENTIFY LOOPS THAT CREATE PROBLEM SYMPTOMS

Treating symptoms can become a full-time job, since each set of fixes creates new symptoms that beg to be "solved." To stop the treadmill, however, we must identify what is causing the problem in the first place. This search for the fundamental cause may lead to very different questions. Instead of looking for ways to solve a "falling sales problem," for example, we should try to understand what factors directly affect sales (aside from the fixes we have already proposed).

Some root causes may include quality of customer service, number of new products, manufacturing lead times, or product quality. As you explore the root causes of falling sales volume, for example, you may discover that the number of new products has been declining in recent months. The next question to ask is: "How is the problem symptom connected to the number of new products (or any of the other potential root causes)?" You

may find that in response to revenue pressure in the past, investments in new products were curtailed. The effects of that decision are now being seen in the reduced number of new products, which further aggravates the falling sales volume (R3 in "Shifting Emphasis to Marketing Promotions").

5. FIND CONNECTIONS BETWEEN BOTH SETS OF LOOPS

"Fixes" and fundamental causes are often linked together in ways that further reinforce the continued use of the fixes. Identifying the links can highlight the many ways fixes can get entrenched in a company's routine.

In our marketing example, as the product attractiveness depends more on promotions, emphasis on promotions will increase, leading to more promotions (R4). Investments in new product development, on the other hand, will be reduced as the company shifts its attention to marketing (R5). The resulting diagram looks similar to a "Shifting the Burden" archetype, as the company grows more dependent on marketing promotions to push sales. (A "Fixes That Fail" structure usually carries the seeds of a "Shifting the Burden.")

6. IDENTIFY HIGH-LEVERAGE INTERVENTIONS

Identifying high-leverage interventions usually means cutting or adding links in the causal maps. These actions represent structural interventions that will alter the policies that affect how people make decisions.

Cutting the links from "revenue pressure" and "emphasis on marketing promotions" to "investments in new product development," for exam-

ple, decouples investment decisions from other responses to falling sales volume. On the other hand, adding a link between "erosion of product image" and "investments in new product development" can channel important market information that can be used to enhance the product's appeal.

7. MAP POTENTIAL SIDE EFFECTS

For every contemplated intervention, try to identify side-effects that may be undesirable (using steps 3–4 above). By mapping them in advance, you can better prepare to respond or perhaps design around them altogether.

The preceding seven steps are meant as guidelines (not as a rigid set of rules) for systematically mapping out the multiple consequences of actions. The resulting diagrams can help clarify the critical issues and provide a common, shared understanding of the problem in order to design more effective and long-lasting solutions. ◘

SHIFTING EMPHASIS TO MARKETING PROMOTIONS
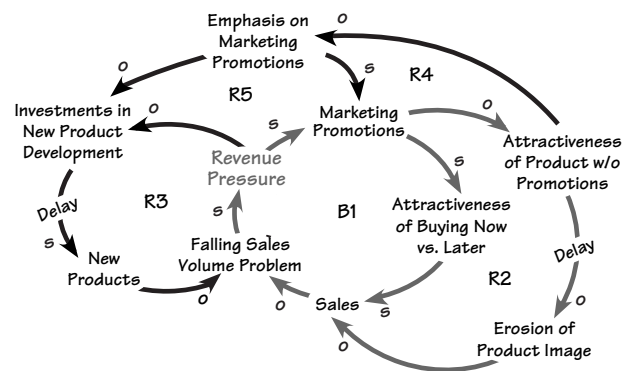
As product attractiveness relies more on promotions, the emphasis on promotions increases (R4) and lower investments in new product development (R5), which will further exacerbate the falling sales volume (R3).

USING "GROWTH AND NDERINVESTMENT" FOR CAPITAL PLANNING

The book *The Day the Universe Changed* tells of a man who once commented to the philosopher Wittgenstein that medieval Europeans must have been foolish to believe that the sun revolved around the earth. Wittgenstein reportedly responded, "I agree. But I wonder what it would have looked like if the sun had been circling the earth" (James Burke, Little, Brown & Co., 1987).

Of course, it would have looked exactly the same. This is precisely the dilemma that occurs in a "Growth and Underinvestment" structure: How can you tell whether your customers are defecting because of actions you are taking, or simply because of the "natural" dynamics of the product lifecycle?

A DYING PRODUCT LINE

A manager in a Fortune 500 consumer products company (CPC) once told a story about a product they had decided to discontinue. They felt that its projected future market potential was not worth further investment. In fact, they were convinced the product was entering its dying stages, so they decided to hasten the inevitable by shutting the plant down.

At the same time, however, they were just beginning a strategic alliance with a Japanese manufacturer who wanted to take over the product line. As a gesture of good will, CPC agreed to license the product—on the condition that they would not renew the license if the Japanese firm was unable to sell at least 5000 units per year. Much to their surprise, the Japanese firm sold over 15,000 units in the first year alone.

It was the same product, manufactured at the same plant, which was operated by the same people. How, then, was the Japanese firm able to produce results CPC could not even imagine, let alone achieve? The answer lies, in part, in understanding the dynamics of the "Growth and Underinvestment" archetype.

How can you tell whether your customers are defecting because of actions you are taking, or simply because of the "natural" dynamics of the product lifecycle?

GROWTH AND UNDERINVESTMENT

The "Growth and Underinvestment" structure is a special case of the "Limits to Success" archetype (see "Growth and Underinvestment: Is Your Company Playing with a Wooden Racket?", June/July 1992). The storyline of the archetype can be described as follows: A company experiences a growth in demand that begins to outstrip the firm's capacity. When the capacity shortfall persists, the company's performance (such as on-time delivery) suffers and demand decreases. The fall in demand, however, is then seen as a reason for not making future investments in capacity, instead of being perceived as a symptom of past under- investments. This leads to a self-fulfilling cycle of continued underinvestment and falling demand. In the end, the decision to shut down production, as in CPC's case, may seem the only appropriate action.

How, then, can an organization avoid doing something that it cannot even see? As in the case of the earth-

centered view of the universe, we need a theory that provides us with a different interpretation of the same observations. The following seven-step process can help us use the "Growth and Underinvestment" archetype to better assess investment choices.

1. IDENTIFY INTERLOCKED PATTERNS OF BEHAVIOR

Ancient astronomers studied the movement of the sun and related its orbiting patterns to the changing seasons. Similarly, to recognize a "Growth and Underinvestment" archetype, we need to identify relevant patterns that appear to be interconnected—such as capacity investment decisions with customer orders or performance measures (e.g., delivery delay). If there appears to be a systematic correlation, it may be an indication that the two are causally linked.

2. IDENTIFY PERCEPTUAL DELAYS

A critical step in analyzing how investment decisions are made is identifying the delay between the time when performance falls (e.g., deteriorating service quality) and when additional capacity actually comes on line. A significant source of that delay is in the time it takes to perceive the declining performance (see "Underinvesting in Service Capacity"). Questions such as "How fast do we believe we should respond to falling performance measures?" or "What are the internal 'hurdles' that a product must pass?" can help reveal mental models that may be blinding the organization to the need to invest.

3. QUANTIFY AND MINIMIZE ACQUISITION DELAYS

In order to identify acquisition delays, you need to have a clear idea of the procedures and people that will be involved. Quantifying those delays requires a thorough understanding of how the whole process actually operates—not just the way it is "supposed" to work.

Minimizing both the perceptual and acquisition delays is important because if the time delay in adding capacity is too long, the performance measure will continue to deteriorate until product sales falls off. When sales fall, it alleviates the pressure on the performance measure (B2), which, in turn, can send a signal that further investments are not necessary (B3). The lack of investment pushes the two balancing loops into a figure-8 cycle that becomes a vicious reinforcing spiral of deteriorating quality and lower demand. Although the decreasing product sales are a result of the company's inaction, it looks as though the customers have made a unilateral decision not to buy the product.

4. IDENTIFY RELATED CAPACITY SHORTFALLS

Expanding capacity for a product often entails further investments in many areas to develop support mechanisms and infrastructures. Expanding service capacity, for example, may lead to increased sales that will outstrip capacity somewhere else. If other parts of the system are too sluggish to capitalize on the added capacity, the customers may still view the company as providing poor service. Demand will then drop, thus kicking off the figure-8 dynamic described above.

5. CHECK FOR ERODING PERFORMANCE STANDARDS

To what extent are current investment decisions based on standards derived from past performance? For example, a 50-hour work week or a 3-month backlog may be the currently accepted signals that trigger additional investments. Yet the signal to expand may seldom come because of the demand-dampening effect that results when we wait too long to invest. An additional danger lies in the existence of a link between current performance levels and the performance standard, which can also create a reinforcing cycle of eroding standards that leads to further underinvestment (R4).

6. AVOID SELF-FULFILLING PROPHECIES

As in CPC's case, we need to ultimately question the deep set of assumptions driving our capacity investment decisions. The BCG Growth-Share matrix is an example of a framework for making strategic investment decisions that can lead to self-fulfilling prophecies. Through rigorous analysis based on a set of assumptions, the process produces categories—question marks, stars, cash cows, and dogs—that guide investment decisions. Problems arise when the labels outlive the relevancy of the analysis and simply become self-sustaining prophecies, i.e., you believe that a product is a "dog," therefore you underinvest in it, and it stays a dog. Avoiding that danger requires going back and challenging the basic assumptions about the product, which includes reevaluating both the product and the market.

7. SEARCH FOR DIVERSE INPUTS

Challenging basic assumptions requires having multiple viewpoints which can move the discussion beyond current understanding. When making investment decisions, try to involve people who have a new perspective on issues such as who the customers are and what they see as the benefits of the product. This may help you break out of the box of current thinking, which is particularly important if you are contemplating abandoning a product.

The real message of the "Growth and Underinvestment" archetype is that investment decisions should be made from a fresh perspective each time. Instead of relying on past performance or past decisions, try playing "intrapreneur" and look at the process as if you are introducing a brand new product. This may provide the necessary perspective to see new life where others see only a dead product. ◨

Note: The "Growth and Underinvestment" archetype is a special variant of the "Limits to Success" archetype. It is difficult to illustrate with general examples because it requires specific detailed information about how investment decisions are made within companies. For additional help in using this archetype, see "Using 'Limits to Success' as a Planning Tool," p. 18.

UNDERINVESTING IN SERVICE CAPACITY
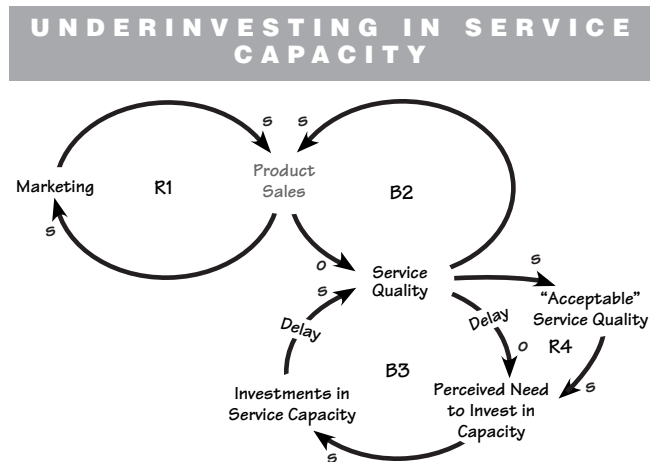
A decline in product sales reduces pressure on service quality (B2). The perception is that further investments in service quality are not needed, so capacity investments decline, leading to a further decrease in service quality (B3). However, the "Growth and Underinvestment " archetype shows that the underinvestment in service quality is actually creating the falling sales demand.

USING "LIMITS TO SUCCESS"
# AS A PLANNING TOOL

"If we don't plan for limits, we are planning for failure."

Any successful product or company begins with a plan for achieving success. Yet people are often better prepared for dealing with failure than for dealing with success. Even though a plan may project healthy growth, we are generally better equipped to deal with one quarter of the expected demand than if we get four times what we expect.

The "Limits to Success" archetype shows that being successful can be just as dangerous to long-term health as being unsuccessful (see "When the 'Best of Times' Becomes the 'Worst of Times,'" Dec. 1990/Jan. 1991). Even success can sow the seeds of failure by stressing and overburdening the current system. Success can also trap us in a mentality of "what worked in the past will continue to work in the future."

The heart of a good planning process is really in understanding the implications of achieving one's strategies for success. When used in a planning process, the "Limits to Success" archetype can help show how actions, whether intentional or unintentional, may end up reinforcing themselves and taking on a life of their own. It can also assist in the
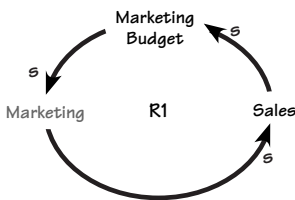
Identifying the "engines" we commonly use to drive growth—such as marketing—can reveal our implicit assumptions about what we believe increase sales (R1).

search for organizational barriers that growth may begin to engage.

Below is a seven-step process for using "Limits to Success" to help identify your engines of success and how they may trigger a process that can potentially lead to failure. By mapping out these structures in advance, you can anticipate future problems and eliminate them before they become a threat.

1. IDENTIFY THE GROWTH ENGINES

The first step in using this archetype is to identify the growth engines. Although the growth in "Limits to Success" is usually described with a single reinforcing loop, this loop can represent any number of reinforcing processes that fuel the initial success. Start by drawing one loop, and then identify additional reinforcing loops that are relevant.

In this process, it is important to focus on dynamic behavior by identifying growth loops, not just growth factors. This helps emphasize the process that is feeding back and regenerating itself. This reinforcing process is often linked to our own mental models, leading us to continue taking actions in a particular direction. For example, a laser printer manufacturer may have found that marketing efforts affect sales, so they always resort to marketing to boost revenues (see "Growth Engine"). Implicit in that loop is a strong bias toward using marketing to address revenue problems.

2. DETERMINE DOUBLING TIME

The next question to ask is what the projected time is for our results to double in magnitude. If marketing efforts continue (at a certain percentage of sales, for example), how long will it take for laser

printer sales to double? Asking questions about doubling time will help make time horizons associated with the rapid growth explicit, especially where new products or markets are involved. If it is a more established product, finding the time it takes to increase sales by 25% or 50% (or to produce another result) would be more appropriate. The key is to pick an outcome that, if achieved, would outstrip your current capacity.

3. IDENTIFY POTENTIAL LIMITS AND BALANCING LOOP(S)

At this point, it may help to categorize the limits in order to explore the many possible side-effects of success (see "Planning for Limits"). If sales double (or increase by 25% or 50%), for example, what sort of limits would we encounter? Some possible categories:

• Physical Capacity—If we double sales, will we need to build a new plant or make capital equipment investments?
• Information Systems—Are current information systems capable of handling twice the current activity?
• Personnel—Will we have enough people to handle double the workload? If not, do we have a plan for hiring and training new people?
• Management Expertise—Will we outstrip our capabilities as an organization to manage the demands such growth will pose?
• Attitudes/Mental Models—Will our actions meet a limit that is imposed more from a worldview than from any physical capacity (i.e., will we run up against sacred cows)?

These categories extend from the most tangible to the least tangible. While capital equipment needs are relatively easy to assess, necessary management

expertise and the required shift in mental models may be more difficult to identify.

Drawing possible balancing loops helps to identify potential limits in advance. Categorizing the limit can help determine the appropriate course of action to remove it. The categories can also serve as guideposts for what to look for as you begin to grow, while helping you anticipate how quickly you can respond to the potential limits.

In the case of the laser printer manufacturer, doubling the sales of a high-end laser printer with advanced features may mean greater demand for technical assistance. If the company is not prepared for this increase in volume, it could limit future sales growth as customers receive poor technical assistance and look for a supplier with better service (see "Capacity Limits").

4. DETERMINE REQUIRED CHANGE

The next step is to assess what changes are required to deal effectively with the limit(s) identified. In terms of personnel, for example, technical assistance needs could be assessed by exploring questions such as: If sales double, will we get more sophisticated users, or less? How reliable is the product compared to previous ones? We can then begin to estimate how many people and what training will be required in order to maintain (or improve) the current level of service.

5. ASSESS TIME NEEDED TO CHANGE

If sales can double in six months, and you've determined that you need to add 20 to 30 new technical support people, what is the actual time frame in which you can accomplish that while still maintaining the desired level of quality? You may find it will take a full year to hire and train the necessary people. If there is a discrepancy between the doubling time (six months) and personnel expansions (one year), you may run into a "Limits to Success." If you are able to identify the time needed in advance, however, you can

plan for those needs and avoid a "Limits to Success" trap.

6. BALANCING THE GROWTH

Once we have determined both the engines of growth and the potential limits, we need to consider how to balance the two processes. One way is to ask questions such as: Are we capable of investing enough in the capacity that is required to sustain the growth? If not, will we choose to somehow balance the growth ourselves, or are we going to let the forces of growth choose for us? Look for links between the reinforcing and balancing loops that will enable you to manage the balance between the two, rather than just react to changes. If the laser printer company discovers they cannot hire technical assistance fast enough to meet the demand, they may choose to balance sales growth with their capacity to service that growth. A link between Quality of Technical Support and the Marketing Budget may be appropriate.

7. RE-EVALUATING THE GROWTH STRATEGY

Even if a strategy is highly successful, we should always be open to questioning

whether or not we should continue pursuing it. Reinforcing processes have their own momentum that can propel us toward continually pushing on the engines of growth. Reevaluating the growth engines and viewing the plan in a broader context of overall company strategy can curb our propensity to pursue undifferentiated growth.

There's an old saying that goes, "Be careful what you wish for; you just might get it." Unfortunately, getting what you wish for may not give you exactly what you want over the long term. Companies can become so focused on preventing failure that they neglect planning adequately for success. The "Limits to Success" archetype can, however, help us ask the right questions to sustain our hard-earned success rather than be limited by it. ◘
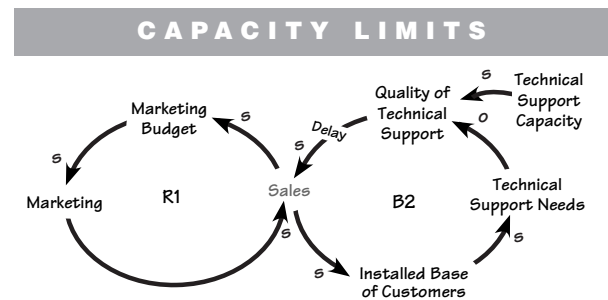
A large increase in sales of a product may require more technical assistance for customers. If we are not prepared to make the required investments of time and money to remove that limit, it could hurt future sales (B2).

PLANNING FOR LIMITS

Performance Measure: Laser Printer Sales
Time to Double Performance Measure: 6 months

CATEGORY OF LIMIT	POTENTIAL LIMITS	REQUIRED CHANGE IF PERFORMANCE MEASURE DOUBLES	TIME REQUIRED TO ACHIEVE CHANGE
Physical Capacity	Production Line	Add 1 assembly line	6 months
Information System	—	—	—
Personnel	Technical Assistance	Hire and Train 25-30 Engineers	1 year
Management	—	—	—
Mental Models	—	—	—

Charting possible limits early in the planning process enables you to anticipate and plan for needed investments before they begin to limit growth.

USING "SHIFTING THE BURDEN" TO BREAK ORGANIZATIONAL GRIDLOCK

"**S**omething there is that doesn't love a wall," wrote American poet Robert Frost in his poem "Mending Walls." As the narrator of Frost's poem engages his neighbor in the annual ritual of mending the stone wall that divides their property, he ponders the origin and meaning of the phrase "good fences make good neighbors." At one time, the wall may have been used to keep the cows separated, but there are no cows now. Perhaps the mending is an old ritual designed to bring neighbors together in community; yet the effort is accomplished in silence. Yes, he puzzles, there is something that doesn't love a wall, and yet the wall remains.

Despite many efforts, walls persist in our organizations as well—often in exaggerated proportions. The logic seems to be "if a waist-high wall is good, a ten-foot one is even better, and if there are any chinks in the wall we should reinforce them with steel beams." The end result is

organizational gridlock. Each "neighbor" is behind his or her wall, laying more brick and mortar until both are locked away in his or her own functional chimney. An "us versus them" mentality quickly develops and begins to govern every interaction. Tremendous organizational energy is wasted fighting our way through the obstructions. And yet, although no one seems to like the result, gridlock still persists.

FUNCTIONAL WALLS

Gridlock may even increase as the couplings between different parts of an organization grow tighter and tighter. Imagine a mesh of beads woven together like a fish net. You can pick up one bead without disturbing any of the other beads until the slack is gone. Then every movement of that bead affects the four other beads directly connected to it. If you pull further and eliminate the slack between the next level of beads, you movement now affects twelve beads, and so on.

The current corporate trend toward de-layering is analogous to pulling on the beads to continually eliminate the slack in the system. As slack is removed, the interdependencies grow in importance. Gridlock results when each bead continues to move as if it were independent of everyone else—each pulling in a different direction, keeping everyone at a standstill. Therefore, as the coupling tightens, our

need for a systemic understanding of the consequences of our actions increases. Before we can work effectively to break through the gridlock, however, we need to first be able to see the "systemness" of our organization.

BREAKING THROUGH GRIDLOCK

Gridlock often can be caused by interlocking "Shifting the Burden" structures. In "Shifting the Burden," a problem is "solved" by applying a symptomatic solution that diverts attention away from more fundamental solutions (see "Shifting the Burden: The 'Helen Keller' Loops," September 1990). When the symptomatic solution creates another problem, prompting further symptomatic solutions, the double "Shifting the Burden" pattern that results can spawn a whole maze of interlocking problems. In the process, the organization's ability to fundamentally resolve the problem atrophies.

"Shifting the Burden" provides a starting point for breaking gridlock by identifying not only chains of problem symptoms, but also solutions that paradoxically form or maintain walls. In a car product development program, for example, gridlock can occur when each of the component or subsystem teams want to optimize their own area without considering the effect on others.

Below is a seven-step process for identifying the "Shifting the Burden" structures that can become interlocked and produce gridlock. By mapping out these structures, you can build a shared understanding about the issue and identify leverage points for action.

INTERLOCKED QUICK FIXES
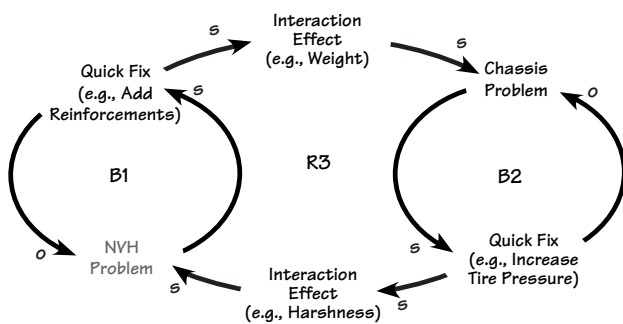
Solutions are never implemented in isolation. When the Noise, Harshness, and Vibration team uses a quick fix such as adding reinforcements (B1), they create a problem for the chassis team. Chassis, in turn, uses a quick fix that solves its problem but creates a new dilemma for NHV (B2). The result is a reinforcing spiral of symptomatic solutions (R3).

1. IDENTIFY ORIGINAL PROBLEM SYMPTOM

When identifying a problem symptom, try not to focus just on a single event. Instead, try looking back over a period of time and identifying a class of symptoms that have been recurring. For example, in the car product development setting, problem symptoms might be missing specifications, wrong part numbers, and incompatible parts—all of which may fall under a more general heading of "coordination problems."

2. MAP "QUICK FIXES"

Next, map out all the fixes that have been used to tackle the identified problem. The objective is to identify a set of balancing loops that appear to be keeping problems under control. For example, in the car product development effort, a Noise, Vibration, and Harshness (NVH) team encounters a noise problem and fixes it by adding reinforcements to the car, which solves the original problem (loop B1 in "Interlocked Quick Fixes" diagram).

3. IDENTIFY IMPACT ON OTHERS

Solutions aren't implemented in isolation, however. Actions taken by one group almost always affect others in the organization. The persistence of gridlock suggests the presence of a reinforcing process that is locking the different players into a patterned response.

In our example, NVH's fix for the noise problem increases the car's weight and presents a problem for the chassis team. Chassis, in turn, "fixes" their problem by increasing the tire pressure (B2), which worsens the harshness and leads to another NVH problem. Another round of NVH quick fixes lead to another round of chassis quick fixes in a vicious reinforcing spiral (R3).

4. IDENTIFY FUNDAMENTAL SOLUTIONS

Having identified the other player(s) who are affected by your fixes, you need to identify a solution that will more fundamentally address the problem(s) by looking at the situation from both perspectives and finding a systemic solution.

A fundamental solution for NVH and Chassis might be to improve the quality and frequency of communication between the two groups so potential problems can be highlighted early and tackled together (B4 and B5 in "Organizational Gridlock").

5. MAP SIDE EFFECTS

Remember, in a "Shifting the Burden" there are usually side effects that steadily undermine the usability of the fundamental solution, leading to a reinforcing spiral of dependency. In our product development example, the fixes may lead each team to focus more and more on meeting their own timing targets, which leads them to invest even less in cross-team communication (R6 and R7).

6. FIND INTERCONNECTIONS TO FUNDAMENTAL LOOPS

Side effects can lead to myopia, but they usually are not enough to create organizational gridlock. Finding links between the interaction effects and the fundamental solution (see "Organizational Gridlock") can identify some reasons why functional walls grow thicker and higher over time. In our example, the interaction effects (e.g., reinforcements leading to an added weight problem for Chassis) lead to an increasing unwillingness to communicate with the other team. The "us versus them" mentality appears and becomes entrenched through these reinforcing loops (R8 and R9).

7. IDENTIFY HIGH-LEVERAGE ACTIONS

When you are in the middle of gridlock, it is difficult to see exactly where you are or how to get out. But, if you are able to get a bird's-eye view, you can see the larger grid. For this reason, the process of mapping out a gridlocked situation can be a high-leverage action. It can stop the finger-pointing and blaming that often occurs in gridlock and provide a starting point for communicating across the walls.

"Shifting the Burden" structures are so ubiquitous that they have become part of our accepted landscape. Following the steps outlined above can help us become more aware of the structures that keep us building and mending walls that have long outlived their usefulness. Mapping out potential problems and interactions before they happen can prevent gridlock from occurring. As Frost suggests, "Before I built a wall I'd ask to know/What I was walling in or walling out, /And to whom I was like to give offense." ◾

ORGANIZATIONAL GRIDLOCK
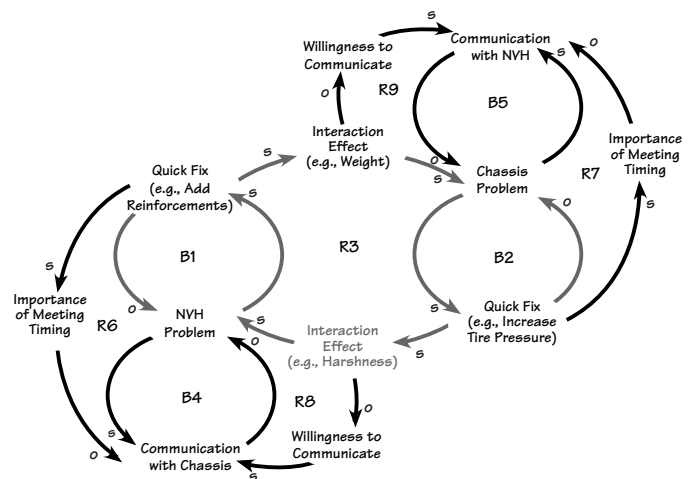
Quick fixes applied by each team create an interaction effect that leads to an increasing willingness to communicate with each other. The "us versus them" mentality appears and then becomes entrenced through these reinforcing loops (R8 and R9).

USING "SUCCESS TO THE SUCCESSFUL" TO AVOID COMPETENCY TRAPS

Have you ever wondered why clocks run in the . . . uh . . . clockwise direction? Or why the QWERTY keyboard design is the standard for virtually all English typewriters and keyboards? Are they really superior technologies, or merely the result of random selection? The answer to these questions lies in the "Success to the Successful" archetype.

In "Success to the Successful," the demands made by competing groups for a common resource (time, money, people, attention, etc.) are linked by two reinforcing loops. Because of the nature of the relationship, giving more to one group means less is available for the other. For example, if more of a limited budget is allocated to Department A, A becomes more successful, which justifies allocating more resources to further its success. At the same time, less is allocated to Department B, leading to a drop in B's success and justifying not allocating resources to B. Over time, both parties' performance reflects the way the resources were allocated—one keeps improving and the other stalls or declines.

In many cases, although it might seem like a "survival of the fittest" strategy, the "Success to the Successful" structure suggests that the final result may be due more to initial conditions than to intrinsic merits. In other words, rather than a survival of the fittest, it is more of a survival of the first.

When clocks were first invented, for example, there were competing designs for the direction of rotation—what we now refer to as clockwise and counterclockwise could easily have been the reverse. There was no mechanical advantage of one direction over the other; one simply achieved greater initial acceptance. The result is that today the other direction somehow seems wrong.

A "Success to the Successful" dynamic is often difficult to stop because of the momentum that occurs from the reinforcing success loop. Halting that process requires a concerted effort to challenge the assumptions or processes that created the dynamic. The following seven steps are designed to help you or your organization critically challenge your success loops in order to learn new approaches and alternatives.

1. INVESTIGATE HISTORICAL ORIGINS OF COMPETENCIES

One warning signal that the "Success to the Successful" archetype is at work is if you hear yourself validating decisions by saying, "X is a good way to go, because it is clear by the progress to date that it outshines all the other alternatives." A critical first step, is therefore to investigate the historical origins of a chosen course of action.

The QWERTY keyboard, for example, was intentionally designed to slow typists down because mechanical keys would jam if a typist was too fast (see R1 in "QWERTY Success Loop"). Although the mechanical problem of jammed keys no longer exists, attempts to replace QWERTY with a superior design (e.g., a Dvorak keyboard) have had little success (R2). The QWERTY system has become entrenched because of the "Success to the Successful" loops and is difficult to dislodge because of the "competency trap" phenomena.

2. IDENTIFY COMPETENCY TRAPS

Competency traps lock us into a particular way of doing things simply because we are already skilled at doing it that way. For example, suppose you bought a software package and have become adept at using it. When a new software is released, everyone raves and says it is superior to the first. But you think, "I already know how to use this one, so I'm just going to keep using it." Each time you use it, you invest more of your time and resources to get to know it better, without gaining any skills in the alternative software. Over time, your competency "traps" you into continuing to use that package.

Such competency traps can turn your organization into a corporate dinosaur because they disconnect you from current progress and engender the

QWERTY SUCCESS LOOP
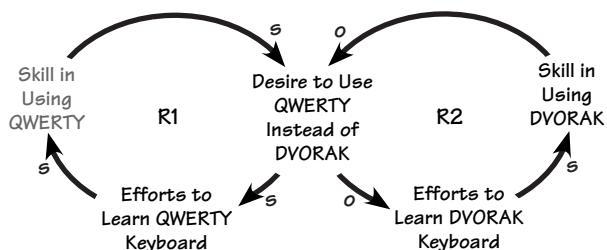
The popular QWERTY keyboard was originally designed to slow typists down because mechanical keys would jam if a typist went too quickly (R1). Despite the transition from manual to electric typewriters, attempts to replace QWERTY with a superior design such as a DVORAK keyboard have had little success (R2) because of this "Success to Successful" structure.

belief that you have the way, the best way, or the only way. Even if your method is currently superior, once you get caught in the "Success to the Successful" loops, you won't realize it when progress passes you by.

3. EVALUATE CURRENT MEASUREMENT SYSTEMS

The measurement systems you use can perpetuate your competency traps by making current successes look good and other alternatives appear less favorable than they actually are. Is your current system weighing too heavily the costs that have already been invested? Does it overly discount the opportunity costs of not switching or not scanning for other possibilities? If you think your system may be skewed in one direction, you may need to question the assumptions behind your current measurement systems and perhaps change them if necessary.

For example, a commonly accepted measure of how well a product development program is being managed is the number of engineering changes that are logged on the computer systems at any one time. If the system is changed so more design changes are made earlier rather than later in the process, the measurement system will send a signal to management that the program is out of control. Even though the new way produces a better result by pulling changes upstream, your measurement system will indicate otherwise.

4. MAP INTERNAL VIEW OF MARKET SUCCESS

When you are successful in a market for a long time, you often begin to believe that your own internal view of success is the same as the market's view. This internal success loop can blind you to shifts in the competitive environment that are obvious to less successful players. Mapping your internal view of success will make the operating assumptions explicit and clear.

5. OBTAIN EXTERNAL VIEWS OF MARKET SUCCESS

To complete the picture, you need to obtain external views of market success. This usually requires getting an assessment from a true "outsider" to the organization or industry. Attempts from within the organization to map the external view run the danger of looking too similar to the internal view. IBM, for example, had a very successful mainframe business that reinforced its belief in the superiority of mainframes over emerging alternatives (see R3 in "Internal View of Success"). IBM therefore made relatively little investment in the PC business, which translated into little success in that market arena (R4). The arrival of personal computers did not change IBM's internal view of success (customers want and need mainframes), so the company was slow to respond to the challenge of the market's view of success (customers want cost-effective computing solutions such as PCs).

6. ASSESS EFFECTS ON THE INNOVATIVE SPIRIT

Competency traps and inaccurate views of the marketplace indicate how the "Success to the Successful" archetype can erode the innovative spirit of the organization. This trap is characterized by the old management adage, "If it ain't broke, don't fix it." Instead of allowing one successful way to predominate, use the archetype to question how you think and perceive. The challenge here is to always entertain alternatives in a highly innovative spirit.

7. BE YOUR BEST COMPETITOR

By nurturing an innovative spirit and continually scanning for new alternatives, you can become your own best competitor. With this mindset, you become the most critical of your own success, continually looking for gaps and areas for improvement. For example, Proctor & Gamble's approach of having multiple brands compete with each other helped the company become and remain the industry leader in many markets. By viewing your successes as if you were another company, you can find ways to create a competing product or service that may be better or more successful.

"Success to the Successful" is one of the toughest structures an organization has to overcome because many choices are often made subconsciously, influenced by the momentum of past actions. It is easy to become trapped in your success by continuing to learn how to do the same thing better. Applying the archetype can hopefully help you design your successes to be a product of continual learning, rather than the inertia of past achievements. ◧

INTERNAL VIEW OF SUCCESS
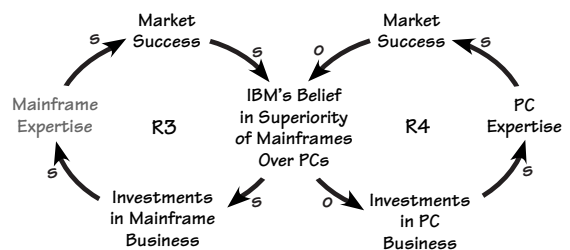
IBM's very successful mainframe business reinforced its belief in the superiority of mainframes over emerging alternatives (R3). IBM made relatively little investment in the PC business, which translated into little success in the marketplace (R4). The arrival of personal computers did not change IBM's internal view of success (customers want and need mainframes), and therefore it was slow to respond to the challenge of the market's view of success (customers want cost-effective computing solutions).

USING "TRAGEDY OF THE COMMONS" TO LINK LOCAL ACTION TO GLOBAL OUTCOMES

"Thought creates the world and then says it didn't do it."

—David Bohm

Traffic jams . . . overfishing the Atlantic . . . last-minute holiday shopping at the mall. A "Tragedy of the Commons" occurs when a system encourages individuals to take action for their own benefit, but gives little or no leverage at the individual level for responding to those actions' collective result (see "Tragedy of the Commons: All for One and None for All," August 1991).

In such a situation, the complex interaction of individual actions produces an undesirable collective effect. To paraphrase David Bohm, each player contributes to the problem, but then says, "I did not do it." Recognizing when you are operating in a "Tragedy of the Commons" archetype is important for understanding the long-term effects of individual actions. The solution lies in both connecting those actions to the collective outcome and finding the leverage for effective intervention.

LACK OF EMPOWERMENT

The strategy behind employee empowerment programs is to step back and allow individuals to solve problems at the local level without interference from above. Yet when the solution does not lie at the individual level, telling individuals to solve a problem themselves can be demotivating—creating the "damned if you do, damned if you don't" dilemma. The long-term effect is often a sense of powerlessness and futility among employees.

Becoming aware of "Tragedy of the Commons" structures in your organization can be the first step toward empowerment. Instead of being forced to react or rebuild the commons later, the greatest leverage lies in identifying the structures in advance. The seven-step process outlined below provides a blueprint for using the "Tragedy of the Commons" archetype to discover these potential leverage points.

The process of using the archetype can be broken down into two stages: assessing the current situation and highlighting potential problems (steps 1–4); and identifying leverage points for action (steps 5–7).

1. IDENTIFY THE COMMONS

The first step in using "Tragedy of the Commons" is to identify the commons—the resource (broadly defined) that is being shared by a group of people. To pinpoint the commons, try looking for shared resources that are considered "fixed" in your time horizon.

For example, in a car development program, the power output of an alternator is considered fixed, even though it may be later redesigned. The potential for a "Tragedy of the Commons" lies in the fact that the component design teams are vying for that fixed alternator capacity to power each of their own respective parts.

2. DETERMINE INCENTIVES

Next, identify the reinforcing processes driving the individual use of the resource. These can be both personal motivators as well as incentive systems that exist within the company (e.g., sales quotas and contests). Bear in mind that sometimes the incentives are not that explicit and that personal motivations are often involved.

In the alternator case above, the engineers' genuine interest to experiment and continually improve the functionality of each part can end up outstripping the available alternator power. The incentive for each component team, however, is to deliver improved functionality—not to manage the overall load on the alternator (loops R1 and R2 in "Overgrazing the Alternator").

3. DETERMINE TIME FRAME FOR REAPING BENEFITS

Having listed the incentives, it is important to determine the time frame in which the individuals reap the benefits of using that commons. This helps to estimate how fast the commons could become overgrazed. Generally, the shorter the time frame for reaping benefits, the higher the incentive to use the resource, and the more difficult it may be to get people to give up the short-term benefits for long-term ones.

4. DETERMINE TIME FRAME FOR CUMULATIVE EFFECTS

The danger of "Tragedy of the Commons" is that the resource depletion can happen invisibly over a long period of time, due to cumulative effects. When the effects finally hit, you may suddenly find yourself paralyzed, without any lead time to take effective action. Trying to determine up front how long it may take before the impact of the collective

action will be felt can help you gauge the window of opportunity for effective action.

In the alternator example, as each team increases the functionality of their component, the electrical load may begin to rise. The collective effect may not be known for weeks, however, due to delays in getting accurate information collected and tabulated. When the total load exceeds capacity, the effect on everyone will be a degradation of component performance (loops B3 and B4).

5. MAKE THE LONG-TERM EFFECTS REAL

Once you have determined the parameters of the problem—the commons, the incentives, and the time frames—you can begin exploring alternatives for creating effective action. One approach is to make the long-term loss more real and present to the individual users. Most likely, in a "Tragedy of the Commons" situation, there is a large gap between how quickly one feels the benefits of an individual action (step 3) versus the pain one will eventually feel from the collective result (step 4).

One way of closing the gap is to develop a measurement system that will translate the cost of future loss into a net present value equivalent. Tying the effects of individual actions to performance measures can help make the link between local action and global consequences more real and immediate. In the alternator example, we may be able to show in real time the overall system degradation each additional demand for power creates.

6. REEVALUATE THE NATURE OF THE COMMONS

In many "Tragedy of the Commons" structures, such as those associated with the ecology of the planet, there is an eventual "collapse" of the commons. Once you reach a certain limit, the commons cannot be replenished.

In most corporate settings, however, there is not a final "collapse." Most common resources are renewable eventually. Replacing the resources, however, can take a long time. Another possible leverage point in a "Tragedy of the Commons" situation, therefore, is to remove the constraints imposed on the commons. Reevaluating the limit may produce some alternatives or possibilities that have not been considered.

In the alternator scenario, for example, we may consider other available technologies that could give us more electrical power. The Japanese prepare for this eventuality by creating alternative technologies and putting them on the shelf even before they have a use for them.

7. IDENTIFY FINAL ARBITER TO LIMIT ACCESS TO RESOURCES

The highest leverage in a "Tragedy of the Commons" is to find the central focal point around which the whole resource can be managed. That could be either a common shared vision that will guide all individual actions, a measurement system that somehow accounts for the collective effect (and makes it "visible" to each player), or a final arbiter who controls and allocates the resource based on the whole system.

One way of creating an overarching vision to guide a project is to apply Quality Function Deployment, which translates customers' needs into a matrix that provides a blueprint of what the customers value most. This way, even as each team tries to optimize their part by using the common resource, the matrix shows which ones should get higher priority.

One example of a final arbiter is the heavyweight program manager common in car product development programs

in Japanese companies. He or she has a great deal of authority for making decisions about design and resource allocation issues.

EMPOWERMENT

How many times have decisions been made at a higher level in an unrecognized "Tragedy of the Commons," where individual morale and empowerment suffer as a result, even though the decision was the "correct" one? Recognizing a "Tragedy of the Commons" at work can be an empowering experience. When people realize a particular problem cannot be "solved" at the individual level, they will feel much more comfortable about the decisions being made at higher levels and also understand at what level the decisions need to be made. ◘

The "Tragedy of the Commons" example used above is based on "Learning to Learn: A New Look at Product Development" in the February 1993 issue of THE SYSTEMS THINKER™.

OVERGRAZING THE ALTERNATOR
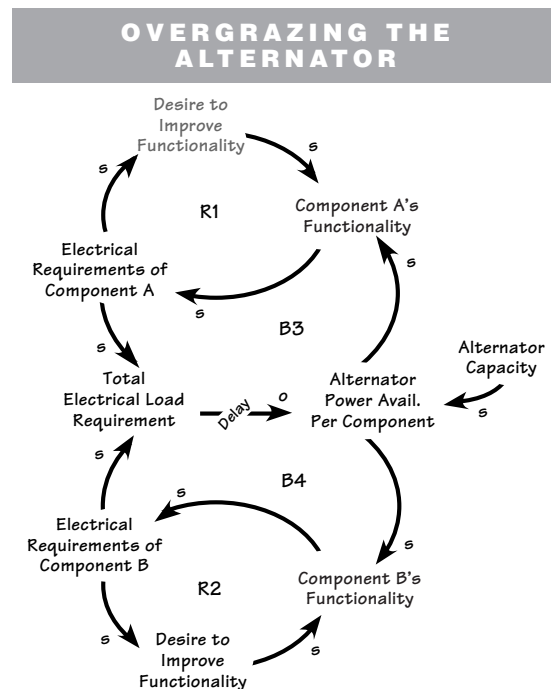
The desire of the teams to improve the functionality of their components can lead to an overload of the "commons"—overall alternator capacity.

1. Double-Q Diagram

Based on TQC tool "Cause-and-Effect Diagram." See Ishikawa, Kaoru (1982) *Guide to Quality Control*, Ann Arbor, MI: UNIPUB.

2. Behavior Over Time Diagram

Based on diagrams referred to as "reference modes" in system dynamics literature. See Richardson, George and Alexander Pugh (1981) *Introduction to System Dynamics Modeling*, Waltham, MA: Pegasus Communications.

3. Causal Loop Diagram

See Richardson, George and Alexander Pugh (1981) *Introduction to System Dynamics Modeling*, Waltham, MA: Pegasus Communications.

4. Systems Archetypes

See Senge, Peter (1990) *The Fifth Discipline*, New York: Doubleday. Also covered regularly with current business applications in a management newsletter, *THE SYSTEMS THINKER*, published by Pegasus Communications, Inc., Waltham, MA.

5. Graphical Function Diagram

Based on diagrams referred to as "table functions" in system dynamics literature. See Richardson, George and Alexander Pugh (1981) *Introduction to System Dynamics Modeling*, Waltham, MA: Pegasus Communications.

6. Structure-Behavior Pairs

Referred to as "Atoms of Structure" in *Academic User's Guide to STELLA* by Barry Richmond, published (as part of software documentation) by High Performance Systems, Hanover, NH. Also, see Goodman, Michael (1974) *Study Notes in System Dynamics*, Waltham, MA: Pegasus Communications.

7. Policy Structure Diagram

Contact Professor John Morecroft at the London Business School.

8. Computer Model

One of the best software for building system dynamics computer models (Macintosh) is *ithink*™ and *STELLA*™ by High Performance Systems, Hanover, NH. For IBM-compatibles, there is *Vensim* by Ventana Systems, and *PowerSim Studio Enterprise 2000* by PowerSim Corp.

9. Management Flight Simulators

Contact Professor John Sterman at the M.I.T. Sloan School of Management (617-253-1951) for copies of computer simulators on People Express, managing product lifecycles, real-estate management, and super tanker management.

10. Learning Laboratory

Kim, Daniel (1989) "Learning Laboratories: Designing a Reflective Learning Environment," Proceedings of the 1989 International System Dynamics Conference, Stuttgart, Germany: Springer-Verlag.

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