

A Systems Thinking Perspective on Manufacturing & Trade Policy

by
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I. Preface

Prompted by my involvement in the Greater Colorado Springs Economic Development Corporation's Manufacturing Base Restoration Initiative, I became interested in using a systems thinking perspective to understand why the U.S. is losing manufacturing (and other) jobs.

I also wanted to understand the extent of the problem, because not everyone believes that the loss of manufacturing and other jobs is a problem. Many even say it's a good thing. My examination led me to the conclusion that, to the contrary, it's a serious problem indeed.

Considering that it's a problem, it's important to develop recommendations for what should be done. Many of the recommendations in this paper are unorthodox and controversial, as readers familiar with trade issues will quickly realize. Therefore, I've made a genuine effort to justify them.

II. The Systems Thinking Perspective

Living beings, organizations, and societies are systems.

Systems thinking is seeking to understand system behavior by examining "the whole," instead of by analyzing the parts. To do so we examine the "structure" of the system, where structure is the interdependencies and interactions among the parts of the system. A key principle of system dynamics is that system behavior is determined primarily by its internal structure, not by external influences. While external forces do affect system behavior, we first look for how the system itself is designed to exhibit that behavior.

A "Far Side" cartoon by Gary Larson illustrates this. It shows two horn-helmeted Vikings looking forward from the dragon-headed prow of their armored vessel. Behind them are oarsmen on each side of the deck: big, burly men on the left and slight, skinny guys on the right. One Viking says to the other, "I've got it, too, Omar ... a strange feeling that we're just going in circles." These Vikings may have a well-defined mission, but they must turn around to look at the structure of the system to understand the behavior they're experiencing.

Another example is that a bell rings because it's designed to ring, not simply because it's struck. Most tables don't "ring like a bell" when we strike them. They go "thunk" and don't ring because their structure isn't designed to ring.

The same is true for organizations and societies, we must understand the structure of the system to understand their response to external influences; and then we must modify structure and policies to get the desired results. When things have gone badly in our society, it's most often because the system was designed for things to go badly ... the system was a "bell waiting to be struck" ... and not properly designed to produce the desired behaviors. So it's not that external influences do not affect system behavior, it's that *first we look for how the system itself may be creating (or will create) behavior.*

We need the systems thinking perspective and the tools & methods of system dynamics to deal with dynamic complexity, just as we require computers, databases, and software to deal with detail complexity. Whereas detail complexity is keeping track of and making sense of lots of data, dynamic complexity is making sense of behavior in systems with multiple feedbacks with long delays.²

In fact, if the relevant feedback is missing, flawed, or not available in a timely manner, organizations and societies fail to learn at all ... or even learn the wrong thing, engaging in what system dynamicists at M.I.T. call "superstitious learning."³

When feedback is delayed or missing, even a routine task such as driving a car becomes difficult due to slowed reaction time, which is why driving while intoxicated is illegal. Organizations and societies must deal with similar delays and missing or defective feedback. By the time we realize something is wrong, decide what to do about it, do it, and then wait to see the results, months or even years can pass.

So in our society, when we encounter delayed or even missing feedback, we have the same problem as an intoxicated driver. While drunk driving is illegal, there's no law against organizations and societies engaging in equivalent behavior. But there should be, because the cost is high.

Finally, some of the diagrams in this paper are complex, but I hope this paper adequately explains the main ideas to those who find the diagrams unfamiliar.⁴

² Though feedback and delays are everywhere, we're generally as unaware of them as we are of the air we breathe.

³ See, for example, in Nelson Repenning and John Sterman, "Nobody Ever Gets Credit for Fixing Problems that Never Happened: Creating and Sustaining Process Improvement" (2001) at http://web.mit.edu/nelsonr/www/CMR_Getting_Quality_v1.0.html.

⁴ See the *CI4* web site for a paper on reading the systems diagrams: <http://www.exponentialimprovement.com/cms/PracticalST.shtml>.

III. The U.S. economy in trouble: A perfect storm.

Why, despite an “economic recovery,” are job losses continuing as shown in Figure 1?⁵ Why was the job recovery in 1991-92 slower than the post-war average?

We have a “perfect storm” of reasons. Here is a summary of some of them.⁶

- **The long wave:** We’re in the trough of the “long wave” when capacity to produce products and services provides a supply that greatly exceeds demand. This has become progressively more the case since the long wave peak in 1973, hence the ever slower job recovery.
- **The speculative bubble of the 90s created additional excess capacity:** When the economy should have been working off excess capacity, more was added. This will prolong the economy’s time in the trough.
- **We’re in a national economic vicious cycle:** As businesses downsize to reduce excess capacity, consumers have less income and lower expectations, which reduces demand. This creates even more excess capacity and leads to even more downsizing.⁷
- **Productivity improvements:** Advances in technology have produced productivity improvements; fewer workers are needed to produce the same output. Also, companies have laid off workers; given the abundance of excess labor supply, they can require those who remain to work harder and longer.
- **The Quality Improvement Paradox⁸:** The paradox that can afflict individual companies, can afflict the economy as a whole. Because improvements in manufacturing are achieved easier and faster than improvements in engineering design,⁹ pressure on engineering design groups to create new products increases and they don’t have time to improve process.¹⁰ Therefore, new products are not being developed at a pace to make use of the freed-up manufacturing capacity made available because of manufacturing productivity improvements.
- **Lagging federal support for engineering and the physical sciences and declining U.S. engineering enrollment¹¹:** This has also hampered our ability to develop innovative new products to make use of the additional manufacturing capacity.
- **Outsourcing prompted by disruptive technologies¹²:** As technology advances, product and service performance improves and can provide more performance than required by the most-demanding customers. This allows modular, instead of integrated, designs to meet their needs. And eventually the module-based designs meet the needs of less-demanding customers, which creates even more demand for module-based designs. Too often, to reduce costs, companies outsource the module design, not seeing that as their core competency. The source of increasing performance shifts to module design and companies that assemble the modules become commodity suppliers. Therefore profits shift to those with the ability to produce the best modules and away from those who assemble the modules into final products.¹³ This has weakened and caused many of history’s best companies to plunge into

Figure 1. Post-recession employment trends



⁵ “A strange recovery: Jobs continue to disappear,” *The Economist*, 8/7/03,

http://www.economist.com/displaystory.cfm?story_id=S%27%29HH%2BRA%3F%20%20P%22%24%0A

⁶ In no particular order, except perhaps a logical order, as some reasons rest on those before, e.g., companies can’t take advantage of lower costs in foreign countries using increased communication and interconnectivity unless there are lower costs.

⁷ Described in a later section on “the long wave. This is the “Keynesian consumption multiplier” that can operate virtuously or viciously.

⁸ The Quality Improvement Paradox is described in John Sterman, Fred Kofman, Nelson Repenning, (1997) “Unanticipated Side Effects of Successful Quality Programs: Exploring a Paradox of Organizational Improvement,” *Management Science*, Vol. 43, April 1997 at <http://web.mit.edu/jsterman/www/ADI.pdf>. Also described in “A Systems Thinking Perspective on A Manufacturing Base Restoration Initiative,” (Powell, 2002a).

⁹ Engineering design is more technically and organizationally complex than manufacturing; this favors manufacturing improvements because they are the “low-hanging” fruit.

¹⁰ Besides, engineers tend to see process, which is required for process productivity improvements, as a constraint on creativity.

¹¹ See “Lagging Support for Engineering” & “Declining Technical Talent Pool,” (Right Place, 2002) pp. 76 - 80, 91

¹² The dynamic driven by disruptive technologies is described in “Skate to Where the Money Will Be,” Clayton M. Christensen, Michael Raynor and Matt Verlinden, *Harvard Business Review*, Nov. 2001, pp. 73-81. A link to a system dynamics stock and flow model of the structure can be found at <http://www.exponentialimprovement.com/cms/survdisrupttech.shtml>.

¹³ For PCs, think IBM, Digital Equipment and Control Data. PCs are now commodities with Dell the primary supplier and other PC makers under increasing pressure, and with profit increasingly goes to companies like Intel, Microsoft, Teradyne, and Applied Materials.

crisis and fail. To the extent module outsourcing has gone to foreign countries, the U.S. has lost competitive advantage.

- **Tax policies that promote investment:** When supply exceeds demand, tax policy should be geared to increasing demand, not promoting investment. No matter how much taxes are cut for corporations and the wealthy, there will be no hiring without demand.
- **Too strong dollar due to currency manipulation by other countries:** An artificially strong dollar makes U.S.-made goods less competitive relative to foreign-made goods.
- **Too strong dollar due to high real interest rates:** (same as above)
- **High real interest rates relative to the growth in productivity:** When real interest rates exceed the growth in productivity, it drives investment to financial assets instead of real assets (e.g., the leveraged buyouts of the 80s drained the funds of companies with real assets, weakening manufacturing).
- **Low foreign taxes that do not meet their long-term infrastructure needs:** Artificially low foreign taxes reduce the cost of foreign manufacture and make U.S.-made goods less competitive.
- **Foreign government subsidies of industry:** Foreign subsidies make U.S.-made goods less competitive.
- **Low costs in foreign countries with low labor and environmental standards that do not maintain public safety and health:** Lack of standards reduces the cost of foreign manufacture and makes U.S.-made goods less competitive. Non-democratic governments that do not have the technical expertise cannot properly value the environment or the health of their citizens.
- **Lack of robust intellectual property protection standards:** Countries that do not respect intellectual property have lower costs and competitive advantage.
- **Increased communication and interconnectivity due to advances in technology:** Easier transfer/substitution of foreign factors of production (capital, labor, land) makes it easier to take advantage of the lower costs of foreign manufacture and reduces the demand for U.S. labor. Advanced technology and communication has more easily allowed companies to become “economic migrants” to take advantage of the “absolute advantage” of operating in low-cost countries.¹⁴
- **We’re in a worldwide economic vicious cycle:** As businesses under cost pressure outsource to foreign countries to reduce costs, and a lower-paid foreign worker displaces a higher-paid U.S. worker,¹⁵ there is less aggregate worldwide buying power. This reduces demand and puts businesses under even more cost pressure, leading to even more outsourcing and displacement of U.S. workers.
- **The Federal Reserve raised interest rates to burst the speculative bubble of the 90s:** When the bubble did burst, it made the downturn worse than it would have been. Speculators generally have high enough expectations of returns that they are not deterred by a few percentage points increase in interest rates. The Federal Reserve should have instead increased margin requirements to lessen speculators’ ability to borrow to fuel their speculation.
- **Investment tax credits to companies that shift production to foreign countries:**¹⁶ Unless the nation retains manufacturing, it does not fully profit in jobs and taxes from the innovation in which it has invested.
- **A generally too high Federal Reserve NAIRU¹⁷ target has resulted in generally lower employment than necessary:** This has led the Federal Reserve to set real interest rates high and to too greatly restrict the money supply. This has slowed economic growth and reduced demand for labor by assuring there are more people than there are jobs.¹⁸
- **Large and growing infrastructure backlogs make the U.S. less competitive:** Nationwide, the infrastructure backlog is \$1.6 trillion and growing at a rate of 9.25% per year. This is a nontrivial problem. For example, in *Business Dynamics* John Sterman writes about automobile addiction and its effects:¹⁹
... Americans spend 8 billion hours/year stuck in traffic. The cost of driving includes about \$6000/car/year

¹⁴ It is “absolute advantage” that is operative, rather than the theory of “comparative advantage.” See a later section.

¹⁵ There is often an order of magnitude difference in the rate of pay, with many foreign workers paid at near subsistence levels.

¹⁶ See the section on “Why innovation alone isn’t enough: Profiting from Technological Innovation” in “A Systems Thinking Perspective on A Manufacturing Base Restoration Initiative,” (Powell, 2002a).

¹⁷ Non-Accelerating Inflation Rate of Unemployment. Quote from <http://www.courses.fas.harvard.edu/~ec1420/>: “Employment depends on the overall macroeconomic environment ... depends in the short run on aggregate demand ... depends in the long run on the NAIRU.”

¹⁸ The rapid growth of temporary & part-time labor, even during the growth spurt of the 90s, showed there was enough labor around that companies didn’t have to hire people full-time to assure they had sufficient labor. For a full explanation and the effects of this policy on the dynamics of the system, see *The Tangle of Growth* (Powell, 2001). Download Appendix II. Federal Reserve policy and wages. at http://www.exponentialimprovement.com/cms/uploads/Tangle_of_Growth6eApp2Fed.PDF.

¹⁹ Sterman, 2000, p. 178. An overview of “what went wrong” & how it affects growth & sprawl is in *The Tangle of Growth* (Powell, 2001).

in direct costs and up to another \$9400 in indirect, externalized costs. Estimates of lost productivity due to traffic congestion range from \$43B to \$168B per year. ... Road rage is increasingly recognized as a common mental disorder, and frustrated drivers have taken to shooting those who cut them off on the so-called freeway. What went wrong?

- **U.S. companies carry the burden of paying a large portion of health insurance costs** and are in competition with other developed countries that have lower cost, publicly-run universal health systems. In addition to reducing costs to businesses, universal health and subsidized single-payer systems avoid the spiraling costs due to adverse selection and not taking advantage of positive externalities.²⁰

IV. The Challenge of Dealing with the Mess

So ... this is quite a long list of reasons why job losses continue, despite the official "end of the recession." The list kept growing and I felt a rising sense of panic.

That there are so many reasons is an indication that designing effective policies will be difficult. We can't just "fix one thing" and expect improvement. These problems are of increasing dynamic complexity; that is, many of these effects interact in feedback loops with long delays on the order of years and even decades.²¹ It is extremely difficult to learn in systems with long delays. Sterman describes the problem (Sterman, 1992):

Even in perfectly functioning markets, modest levels of dynamic complexity caused large and systematic deviations from rational behavior. Complexity reduced subjects' ability to reach and maintain ... equilibrium, slowed learning, and reduced the consistency of decisions.

We must begin to think long-term, in decades, not quarters or even years (Sterman, 1994):

When short-run performance is rewarded, strategies yielding superior quarterly or annual results proliferate even though they may cause long-term ruin. The bias toward reward of short-run results is reinforced by the misperceptions of feedback, which make it hard to assign credit for long-term results to particular strategies or people.

This won't be easy because the loss of manufacturing and other jobs is not simply a serious "problem," where a problem is defined as a "gap between goal and actual." It is not even a "mess," where a "mess" is a "tangled set of interrelated problems," that is, a "system of problems." It is what might better be called a "wicked mess," that is, a mess that exists in a coercive environment replete with inequalities of economic and political power.

So it's not a problem to be solved or even a mess to be managed. And it's not about predicting a predetermined future and preparing for it. It's about *defining a desired future and creating it* by designing structures and policies to achieve the desired results. It can be done, if we have the collective will to do so.

And we'd better, because the loss threatens our economic and national security. Current policies aren't working and without appropriate action, job losses will continue in manufacturing and engineering and wages will continue falling. This creates a continuing vicious cycle of less demand in the U.S., increased cost pressures, more offshore outsourcing, and more job losses and lower wages.

There will be business cycle recoveries along the trough of the long wave, which will be interpreted by many as long-term recovery, but we should not become complacent. Because of the long list of reasons for the job losses, the economy could very well be in the trough for another decade or more.

Sterman describes the trough (Sterman, 1994):

During the trough, we may very well have a business cycle recovery, but, as has occurred since 1991, the rate of real economic growth will likely be anemic compared to typical post-war recoveries:²² unemployment will remain high, real incomes will not grow significantly, and social and political pressures for change will intensify.

The remainder of this paper describes some of the reasons why the loss of manufacturing from the U.S. is a major problem and what to do about it.

²⁰ For more on this see the paper on [Health Care Dynamics](http://www.exponentialimprovement.com/cms/HealthCareDyn.shtml) at <http://www.exponentialimprovement.com/cms/HealthCareDyn.shtml>.

²¹ The period of the long wave is between about 45 and 60 years. More on this in a later section.

²² Sterman did not foresee the speculative economic bubble of the 90s.

V. The loss of manufacturing is a major problem. Here's why.

Many believe the loss of manufacturing and manufacturing jobs isn't a problem, believing that other countries can do the manufacturing and we'll do the high value-added innovation and design.

This belief itself may be the greatest threat to our economic health. Here are some of the reasons why the loss of manufacturing isn't just a problem, it's a really big problem.²³

1. No magic wall exists between "innovation & design" and "manufacturing." An "innovation and design" economy won't replace the "old manufacturing economy."

- ♦ The "innovation and design" and "old manufacturing" economies are each other's customers.²⁴

The Right Place's "Manufacturers Council Position Paper" (Right Place, 2002, p. 27) explains one important reason:

The service sector acquires most of its technology from the manufacturing sector, and sells a significant portion of its value added back to that sector. Most information technology creates a supporting infrastructure: It supports other economic activity, including manufacturing.

- ♦ The loss of manufacturing jobs leads to the loss of design jobs. There is no magic wall between "innovation and design" and "manufacturing."²⁵

While we often consider engineering and manufacturing separately, they are tightly coupled ... or should be. Here are two reasons:

▪ Without manufacturing we cannot take advantage of manufacturing & engineering synergies:

The only way to make manufacturing competitive and keep it in the U.S. is to get down the learning curve as quickly as possible in manufacturing and in engineering. Much of the improvement potential in one depends on improvement in, and learning from, the other.²⁶

▪ High technology work is also moving to lower wage countries:

As noted in the Denver Post article, "Tech work the state's latest export, Firms find lower costs, skilled labor overseas,"²⁷

Requisite Technology's Toronto office has mushroomed from 10 employees to 350 in less than three years, eclipsing the e-commerce company's Westminster headquarters.

Desktop software maker Quark Inc. employs about 400 programmers in Germany and India - as many as it does in Denver.

TeleTech Holdings Inc. is adding call-center workers in places like Mexico and Northern Ireland at such a dizzying pace that foreign employees now outnumber those in the United States.

What does all this mean? That Colorado companies, which shipped a record \$6.6 billion in goods overseas last year, are quickly growing another kind of export: jobs.

These aren't sweatshop jobs, though some Colorado manufacturing firms still create those. They're positions for call-center representatives, computer-equipment makers, software engineers and other information-technology specialists paying from \$18,000 to \$60,000 a year. ...

No organization tracks how many workers Colorado companies employ outside the United States or the total value of their investment, so estimates are difficult. But Denver-based TeleTech's overseas operation - 13,000 people earning a total of at least \$250 million a year - gives a hint.

U.S. and Canadian companies spent \$13.7 billion last year on offshore technology work, according to Input, a Chantilly, Va.-based market research firm.

India is the leading destination for U.S. companies seeking technology labor, Input says, but Ireland and Israel aren't far behind. Still others, such as Mexico, the Philippines, New Zealand, Northern

²³ I thank Jim Leonard, jleonard1@mindspring.com, Innovation & New Product Development, University of Colorado at Denver, and Paul Carson, Agilent Technologies, and Cindy Message, Agilent Technologies, for feedback and suggestions without implicating them for any errors, misstatements or faulty conclusions.

²⁴ Comment from Jim Leonard: "This should be obvious to intelligent observers. There would be no "knowledge economy" without the product design and manufacturing foundation laid by such companies as Intel, HP, IBM, Motorola, Microsoft, Cisco, Applied Materials, etc. in the 1980s and 90s, before the outsourcing boom happened."

²⁵ Comment from Jim Leonard: "An insightful statement that should be obvious to any enlightened observer. Certainly CEOs should understand this, but it is obvious that many don't."

²⁶ See the section on "Why it's important: Interactions between Manufacturing and Engineering" in "A Systems Thinking Perspective on A Manufacturing Base Restoration Initiative," (Powell, 2002a).

²⁷ "Tech work the state's latest export, Firms find lower costs, skilled labor overseas," Greg Griffin, *Denver Post*, March 11, 2001, <http://www.denverpost.com/Stories/0,1413,36%257E163%257E7924,00.html> .

Ireland, Scotland and Malaysia, also are catching on.

As Geoffrey Colvin notes in his "Value Driven" column in *Fortune* on "The U.S. Is Falling Asleep on the Job" (Colvin, 2003):

... the outflowing jobs are higher paying and have more intellectual content. That's a difference not just of degree but of kind. Until now, smart, educated people in the U.S. have thought up ways to create wealth and then paid others to do the labor, often in foreign countries.

... developing countries, which obviously have always had people just as smart as ours, are now turning out people just as educated. They can design the work, too, and, because educational and living costs are a fraction of ours, companies in those countries can afford to hire those people. That is a profound change: Designing the work is the essence of business, management, competitiveness. ...

What makes anyone think that progression is suddenly going to stop? The next rungs on the ladder are product innovation, brand building, and overall management. ...

We don't have to lose out in this historic shift. But nothing says we're destined to win either. We've never seen this movie before. ...

Jobs have left before, but this time America's place in the global economy is at stake.

Agilent Technologies has "had several situations where the manufacturing could move to a country but the benefit was there only if [it] also kept R&D in that location and it was kept for a number of years ... otherwise, all credits would evaporate."²⁸ Clearly, such countries are interested in making the up-transition from manufacturing to design.

2. National security is compromised as the U.S. manufacturing base degrades.

Government must recognize that keeping manufacturing in the U.S. is vital to national defense and economic security. We must take this threat seriously and act to halt and reverse the rapid and ongoing hollowing out of the U.S. manufacturing base.

One of the "U.S.-China Economic and Security Review Commission Contracted Research Papers,"²⁹ is on "The US Industrial Base and China" described as "Investigations into the Military Implications of Technology and Skill Shifts to and Dependencies on the People's Republic of China by the U.S. Defense Industrial Base."³⁰ They point to national defense implications of the loss of manufacturing from the U.S.

Here is the Conclusion section:

An Analysis: The US Industrial Base and China By Pat Choate & Edward Miller

Conclusion

While industrial and military self-sufficiency was U.S. policy for more than two centuries, that policy no longer exists. Instead, the U.S. Government has elected, through many uncoordinated decisions made over a number of years, to globalize the U.S. economy and its defense industrial base.

Consequently, the U.S. manufacturing sector is rapidly hollowing out. Basic and high technology industries are shifting their production, research and development, and now back office functions to other nations. A host of U.S. policies are encouraging these shifts.

One consequence of this policy shift and the economic hollowing out is that a large and growing portion of the manufactured goods used in both the U.S. economy and the U.S. defense sectors are coming from factories based in other nations. More significant, more than half of all merchandise imported into the United States, other than from Canada and Mexico, now comes from factories located in China and the nations that immediately surround it.

Another result is that as the U.S. military increases its reliance on readily available commercial technologies, it is also relying on suppliers located in other nations. Moreover, many of these components, particularly electronics are coming from China and the nations clustered around it. The two key policy questions this raises are: Would that long supply line across the Pacific be secure in time of war and are reliable alternatives available?

Today, the United States Government does not know the source of many key components used in its weapons systems. Without that knowledge, the Department of Defense cannot assure the reliability of supply during a time of prolonged warfare.

Nor can the United States be assured of the integrity of many items it is using in its vast system of electronic networks that underpin both the domestic and military economies. Increasingly, these networks rely on imported components that are vulnerable to sabotage or being modified to carry "Trojan horse" programs and

²⁸ E-mail communication from Cindy Message, Agilent Technologies, 9/16/03

²⁹ <http://www.uscc.gov/rese.htm>

³⁰ <http://www.uscc.gov/analysis.htm>

viruses that could be used against the United States in an information war. Moreover, a number of sources claim that China's military doctrine is to make a first strike at an adversary's information system. This is the U.S. "Achilles heel."

Ultimately, the key concern identified in this study is less that of the transfer of high technology capacities to China, which is inevitable, but the hollowing of the US defense industrial base, which is not.

The authors note:

America is becoming increasingly dependent on foreign factories and workers to supply its vital goods. Among those goods imported into the United States in 2001 where related trade constituted 50 percent or more of the value were:

- Resin, synt rubber & fibers (62 percent);
- Pharmaceuticals & medicine (72 percent);
- Chemical products — (66 percent);
- Rubber products — (61 percent);
- Alumina & alum processing (61 percent);
- Ag & construction mach, — (52 percent);
- Metalworking machinery — (51 percent);
- Engines, turbo, power eqpt. (56 percent);
- Computer equipment — (70 percent);
- Communications equipment (67 percent);
- Audio & video equipment (70 percent);
- Semiconductors & elect. (64 percent);
- Navix, measure, med instru.— (62 percent);
- Magnetic & optical media (56 percent);
- Electrical equipment (61 percent);
- Electrical equip & comp — (51 percent);
- Motor vehicles — (95 percent);
- Motor vehicle parts — (58 percent);
- Med equipment & supplies — (52 percent).

They further note:

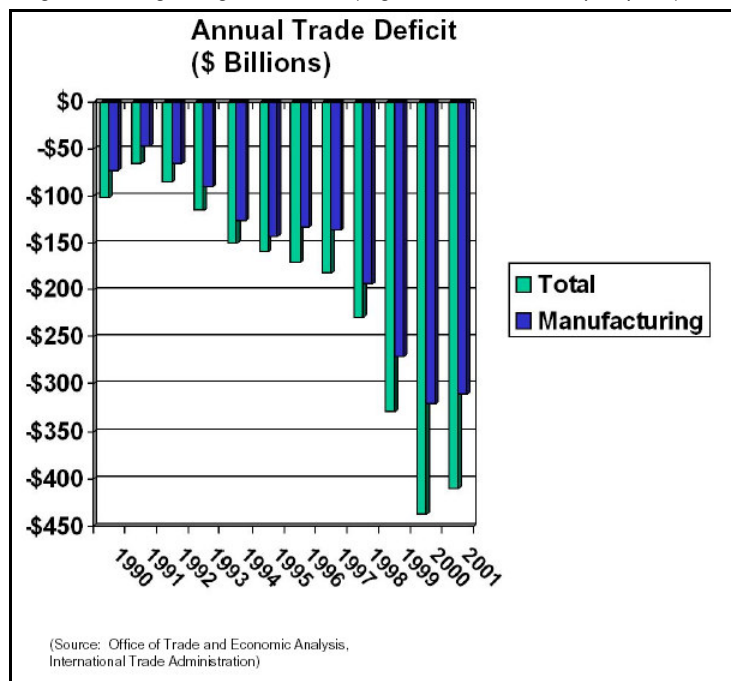
The rapid and on-going hollowing out of the U.S. manufacturing base — as documented by monthly trade data supplied by the U.S. Commerce Department — is consequential for several reasons.

Job Losses — Hundreds of thousands of U.S. manufacturing workers are losing their jobs as companies leave the United States — including more than 1.3 million lost within the last year. ...

Dependency on Foreign-Based Suppliers — Regardless of whether the foreign factories that supply goods to the United States are U.S. or foreign owned, their location thousands of miles away raises questions about their reliability in times of crisis. Today, more than a third of all merchandise imports into the United States come from a cluster of factories in China and surrounding places — Hong Kong, Taiwan, Indonesia, Japan, South Korea, Malaysia, the Philippines, Singapore, and Thailand. ...

Information War Vulnerability — China, an emerging economic rival, and a soon-to-be super power, is rapidly becoming a major supplier of America's high technology goods, including electronics. ...

Figure 2. The growing trade deficit (Right Place Position Paper, p. 72)



3. The U.S. trade deficit is increasing exponentially. What cannot go on forever will stop. The longer this trend persists, the greater the eventual repercussions and dislocations.

Figure 2 shows the trade deficit, which has doubled since 1997 (Right Place, 2002, p. 72). The trade deficit in July 2003 was \$40.3 billion, an annual rate of \$484B.³¹ The implications of this graph are frightening because it shows the trade deficit is increasing exponentially, only slightly retarded by the 2001 recession. This cannot be maintained indefinitely.³²

Figure 3 shows the economy recovered once from a \$3 billion plus deficit, but it will probably be more

³¹ NPR News, 9/11/03.

³² Exponential increases in *anything* cannot be maintained indefinitely. Balancing negative feedbacks will always arise to oppose exponential growth created by reinforcing positive feedback. A principle of system dynamics is that nothing grows without reinforcing feedback and nothing grows forever, balancing feedbacks will always arise to limit growth.

difficult this time:³³

[E]xcessive reliance on America is also the biggest problem facing the global economy today. As Lawrence Summers, Treasury secretary under Bill Clinton, once put it: "The world economy is flying on one engine."

The statistics are startling. Since 1995 almost 60% of the cumulative growth in world output has come from America ... America's disproportionate contribution to global growth reflects an extraordinary rise in American spending. Domestic demand in America has risen, on average, by 3.7% a year since 1995, twice the pace of the rest of the rich world.

Just as flying on one engine is inherently risky, so a one-engined world economy is more likely to crash. Global prosperity depends overwhelmingly on American demand. If it were to drop significantly, the world would tumble into recession. Yet for years Americans have been spending far beyond their means.

America's national saving rate is at an all-time low. The country's current-account deficit-in effect, the amount it must borrow annually from foreigners to spend more than it produces-has been rising fast, and is now running at over 5% of GDP, a historic high (see chart 2). As a result, the United States, which as recently as 1980 was the world's biggest creditor country, has now become the world's biggest debtor country.

... borrowing from abroad at an accelerating rate can go on only for so long. Eventually the interest on the debt will become too onerous. Long before then, however, foreigners will become reluctant to provide the necessary capital. Already the share of America's current-account deficit that is funded by private foreign investors has fallen. It is Asia's central banks - mainly Japan's and China's-that are picking up an ever bigger share of the tab by buying huge quantities of American government bonds.

Their motivation is not altruistic. By piling into American bonds, Asia's central banks keep their currencies weak, supporting Asia's exports to America. But America's growing trade deficits are now causing protectionist pressures at home, particularly against China.

In the past three years almost 3m jobs have been lost in American manufacturing, one out of six in that sector. With a presidential election due in 2004, demands for action against China are multiplying. Either Asia's currencies will have to adjust, or America will retreat from free trade. On both political and economic grounds, it seems, the world's reliance on one engine is reaching its limit. ...

But how can the world be weaned off its over-reliance on American spending without sending the global economy into recession? In theory, the route to a more balanced world is clear. Americans must spend less and/or foreigners must spend more and/or the dollar must fall (because a cheaper dollar shifts Americans' spending away from imports and boosts exports). Ideally, most of the adjustment should come from higher spending by foreigners. If other countries revved up their economies, they would suck in more American imports. That would allow America's current-account deficit to fall without causing the world economy to suffer.

It has been done before. In the early 1980s, when Ronald Reagan was president, America also borrowed furiously from foreigners, pushing up the current-account deficit to over 3% of GDP. In the later part of the decade, that deficit came down again without causing a global recession, thanks to a big but controlled drop in the dollar and especially to booming economies in Germany and Japan.

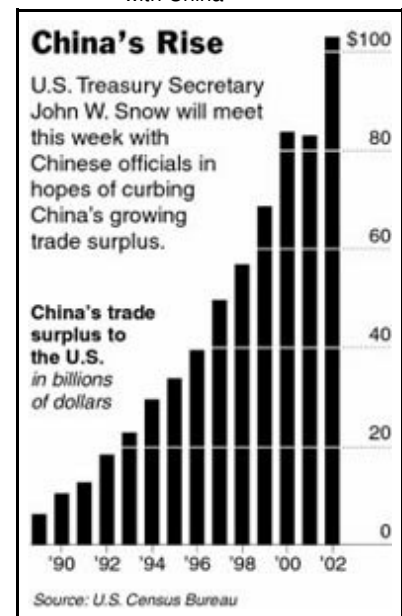
Figure 4 shows the exponentially increasing trade deficit with China, which is ~22% of the total.³⁴ The trade deficit through July 2003 has reached a \$112B yearly rate, continuing the trend.³⁵

Lester Thurow explained what will happen (Thurow, 1996, p. 17):

Figure 3. The growing trade deficit ... again.



Figure 4. The growing trade deficit with China



³³ "Flying on one engine," *The Economist*, 9/18/03, http://www.economist.com/surveys/displaystory.cfm?story_id=2050678.

³⁴ Joseph Kahn, "China Seen Ready to Conciliate U.S. on Trade and Jobs," 9/02/03, *New York Times*, <http://www.nytimes.com/2003/09/02/business/02CHIN.html>

³⁵ "Economists Predict GDP Growth Will Be Fastest Since Late 1999," *The Wall Street Journal*, 9/11/03. Quote: "The U.S. registered a \$65.3 billion trade deficit with China during the first seven months of the year, up sharply from \$52.5 billion a year ago." Found at: <http://209.157.64.200/focus/f-news/981307/posts>.

[I]f there is one rule of international economics, it is that no country can run a large trade deficit forever. Trade deficits need to be financed and it is simply impossible to borrow enough to keep up with compound interest. Yet all of world trade, especially that on the Pacific Rim, depends upon most of this world being able to run trade surpluses with the United States that will allow them to pay for their trade deficits with Japan. When the lending to America stops, and it will stop, what happens to current world trade flows?

So, if the dollar must fall eventually, what's the risk if it doesn't do so gradually?³⁶

The only feasible remedy for the huge U.S. trade deficit, now approaching \$600 billion, is a substantial decline of the dollar. Such adjustment is especially required against the major Asian economies, which have piled up the world's largest surpluses in recent years. If [this continues], the United States will lose additional high-paying manufacturing jobs. [T]he risk of financial crisis [will increase substantially], leading to higher U.S. interest rates, when the dollar ultimately crashes due to the implausibility of continuing to attract \$4 billion of foreign capital every working day to finance our external imbalances.

So, the way we're going, the growing trade deficit will in time cause the value of dollar to plummet, leading to higher interest rates and economic decline.³⁷ It won't be easy to avoid chaos.³⁸

Can history repeat itself? If today's current-account deficit could be painlessly reduced, just as it was in the 1980s, the one-engined world might not be such a problem. But the chances of a repeat performance are slim. The imbalances are much bigger and more entrenched, and the world economy as a whole is both more fragile and more complex. There are no other obvious engines, and there is no easy way to get the dollar down.

With no alternative engines ready to kick in, the dollar will have to play an even more important role in America's adjustment than it did in the 1980s, when it fell by 55% against the D-mark and 56% against the yen. Since its peak in 2002, the dollar has already fallen by a total of 8% against its trading partners. But that is nowhere near enough.

Many economists reckon that, in the absence of a shift in global demand patterns, it would need to fall by 40% or more to make a serious dent in America's current-account deficit. That kind of depreciation is hugely risky. The more a currency falls, the greater the danger that it will fall too far, too fast. A sudden dollar crash could roil financial markets and plunge the world into recession.

Moreover, the dollar is unlikely to fall evenly against other currencies. The Asian central banks' determination to stop their currencies rising has, so far, concentrated the dollar's fall on the euro, with a 20% drop against the European currency since early 2002 compared with 8% overall. A further, even bigger drop in the dollar, targeted on the euro, would probably sink Europe's economies.

To spread the burden of a dollar drop more evenly, Asia's currencies too must appreciate. But that will not be easy either. In Japan — which has the world's biggest savings surplus and intervenes most actively to hold down its exchange rate — a dearer yen would lower import prices and further aggravate the economy's deflationary crisis.

Even in China, the case for a stronger yuan is not clear-cut. Unlike Japan, China is not running a big trade surplus. Its economy, despite rapid growth, is fragile; the banking system is bust. A sudden jump in the currency could cause the financial system to collapse, eliminating one of the few bright spots in the world economy.

With so many imbalances, and no easy adjustments in sight, the global economy is clearly in trouble. Stephen Roach, chief economist at Morgan Stanley (admittedly one of the most pessimistic seers on Wall Street), claims the world faces "its toughest array of macro problems since the end of the second world war".

The risks of a dollar crash or a serious global recession are not insignificant, and a period of sluggish growth and currency volatility seems all too likely.

Addressing this issue is important for national economic security. A strong economy is also important for national defense security, because if we do not maintain economic health, the nation cannot afford large military budgets.³⁹

³⁶ C. Fred Bergsten, "Muzzling Our Economic Negotiators," Institute for International Economics, Op-ed from *The Washington Post*, 9/10/03. <http://www.iie.com/publications/papers/bergsten0903.htm>.

³⁷ The mechanism is that as the cumulative trade deficit increases, the dollars held by other countries increases. Eventually countries see the supply of dollars as too large, demand drops, and the value of the dollar falls relative to other currencies. The lower value of the dollar increases the price of goods in the U.S. and causes inflation. The history of the Federal Reserve is to react with higher interest rates no matter what the cause of inflation (e.g., higher oil prices, speculation-induced price rises) in its efforts to prevent an inflationary wage-price spiral. The Fed increases interest rates to both increase foreign demand for the dollar and reduce the domestic borrowing. Higher interest rates reduce investment, the demand for goods, upward pressure on prices, employment and inflation. Not addressing the exponentially increasing trade deficit in an effort to not impact the economy will, in the end, devastate the economy.

³⁸ "Flying on one engine," *The Economist*, 9/18/03, http://www.economist.com/surveys/displaystory.cfm?story_id=2050678.

³⁹ Many believe that too large military budgets lead to military adventurism, but those who believe large military budgets should be maintained or increased should be particularly concerned about the growing trade deficit.

4. An economy in the trough of the long wave economic cycle is partially responsible for the loss of manufacturing and other jobs; without strong and appropriate government action the economic pain will be great and prolonged.

- ♦ John Sterman of M.I.T. explains the origin of the long wave from a system dynamics perspective

An understanding of the economic long wave is vitally important because *economic policies must be tailored to the phase in the long wave cycle* if they are to be effective. Policies that are appropriate in the growth phase of the long wave are not appropriate during the decline.⁴⁰

Here is John Sterman's description of the origin of the long wave (Sterman, 1992).⁴¹

How does the long wave arise? It is important to stress that the long wave is not some mystical, external force. The long wave has nothing to do with astrology, or the quantum mechanical states of the molecules in our bodies. Nothing supernatural or mystical is involved. Our research at MIT over the past fifteen years shows that the long wave is an endogenous (internal) consequence of ordinary, everyday decision making by folks like you and me. Households, businesses and governments make decisions from their own perspective, decisions that seem to make sense, decisions that are locally rational: but decisions that interact in unanticipated ways. Among the unanticipated consequences of individually rational decisions is the long wave. Here, in a nutshell, is how it works.

The end of the last downturn period or trough was roughly the end of World War II. The United States, and the world as a whole, didn't have enough civilian-oriented goods or services: there were not enough consumer goods to satisfy the needs of a population that had experienced a decade of depression and nearly another decade of war. Worse, there were insufficient capital goods and investment capability to produce the civilian consumer goods that we needed. The economy had to go into an extensive period of rebuilding.

The process of rebuilding necessarily causes the economy to overshoot the long-run needs of replacement of depreciated assets and long-term growth. The only way to fill up a bathtub is to pour water into it faster than water flows out. The only way to refill the depleted stocks of consumer goods and provide for long-run growth and depreciation is to produce consumer goods faster than is needed in the long run, at least for a time. And the only way to produce goods above the long-term need is to build up the capacity of the goods producing sector above those long-term needs. Therefore production of capital plant and equipment must also overshoot: the economy must be able to produce the plant and equipment required to grow the goods producing capacity, which in turn must rise above the long-term need. Thus the capital-producing sector of the economy — the factories, mines, steel mills, railroads, and manufacturers of the other inputs used to produce plant and equipment — had to rise, at least temporarily, above the balanced growth path. To fill the bathtub with consumer goods necessarily meant building up an entire sector of the economy above the sustainable long-term need. Of course, once the tub fills, the need for capital goods can drop back to normal, but by that time these industries will have overexpanded substantially.

The rebuilding process took quite a while because of the severely depleted capital base and obsolete infrastructure. Before we could even begin production of the automobiles, toasters and other consumer goods we needed, we first had to produce the machine tools, factories, rolling stock and barges required to produce those goods. This took time. More important, the rebuilding process was self-stimulating. When the demand for capital goods increases it generates the need for additional capital. If I am in the steel industry and the demand for steel increases substantially, I have to build a new mill, rail facilities, barge terminals and ore carriers. All of those require further steel. The economy is tightly connected in a web of input/output relationships which create a very powerful self-reinforcing feedback process that further stimulates expansion.⁴²

Employment increases dramatically during the expansion period as producers seek to meet the rising demand for plant, equipment, and goods. Labor markets tighten as the unemployment rate falls, and wage rates rise. Consumer incomes climb at above normal rates and thus, consumer demand is stimulated, a further self-reinforcing feedback that stimulates the growth of demand.

During the 1950s and 1960s the expansion process was vigorous. By the mid 1960s, high capacity utilization and low unemployment were leading to inflationary pressure. The high demand for credit to fund the expansion in capacity industry desired, combined with upward price and wage pressure, led to faster expansion of the money supply, fueling more rapid inflation. Given interest rates, an increase in inflation lowers the effective or real interest rate. Nominal interest rates began to rise during this period, but lagged behind the accelerating rate of inflation, so real interest rates fell. During the 1970s, as inflation accelerated further, real

⁴⁰ This section is extensive because an understanding of this dynamic is vital for setting appropriate economic policies.

⁴¹ The insightful paper by John Sterman at MIT on the long wave should be required reading for all economists, politicians and citizens. It's D-4329 "The Long Wave Decline and the Politics of Depression," Presentation to the Bank Credit Analyst Conference, New York City, September, 1992, pp. 41, \$4.00. It's available from MIT: <http://web.mit.edu/jsterman/www/pub.html>. The paper provides a system dynamics explanation of the origin of the long wave cycle caused by capital stock expansion & contraction and business cycles from inventory expansion & contraction. It also describes the characteristic political climate at each phase.

⁴² Readers trained in economics will recognize these feedbacks as the investment accelerator and multiplier processes. See Sterman (1985, A Behavioral Model of the Economic Long Wave, *Journal of Economic Behavior and Organization*, 6, pp. 17-53) and (1986, The Economic Long Wave: Theory and Evidence, *System Dynamics Review*, 2(2), pp. 87-125) for more detailed discussion.

interest rates were often significantly negative. Obviously, a situation where the bank pays you to borrow creates a powerful incentive for increased debt-fueled spending and investment in capacity and assets of all types, further stimulating the expansion.

Thus even as firms seek to expand capacity to meet demand, their actions create macroeconomic side-effects that further increase the demand. What begins as a simple rebuilding of capital stocks and consumer goods is strengthened and prolonged by a wide range of self-reinforcing feedbacks to become a decades-long boom.

Capacity eventually catches up with demand, however. In the present long wave cycle this began to happen in the 1970s. The balance point was not reached all at once nor was it uniform across all industries. The same self-reinforcing feedbacks that powered the upswing reverse, and the downswing gathers momentum. Capital producers find they no longer need to build as much new plant and equipment. As they scale back their own investment plans, they further reduce the demand for plant and equipment, leading to further cutbacks in orders and still more excess capacity. Unemployment starts to radiate out from the capital goods industries into the durable goods industries and then moves into services, including the financial and government sectors. This further undercuts consumer incomes and aggregate demand and leads to further excess capacity which reinforces the downward cycle. Unemployment and excess capacity lead to stagnating or falling wages and prices, further accelerating demand reductions. Individual companies faced with excess capacity and a flat or falling market will seek market share advantage leading to price wars and low margins which reduce inflation and raise real interest rates, further deterring investment. The debt accumulated during the growth period to fuel the expansion becomes an increasingly heavy burden, with high interest rates that cannot be sustained. High debt loads and high real interest rates lead to high rates of business failures, defaults and rescheduling, which further undercut demand, and cause even more cutbacks. Once the long wave peaks the same processes that powered the upswing work in reverse to drag the economy into the downswing.

When we first formulated this theory at MIT in the early 1970s there was little empirical evidence to support it, and it was quite controversial. Fifteen years later there is more than ample data documenting the feedback processes just described and their painful consequences for the economy. There is little doubt now about the existence of the long wave. What remains is to understand how the economy might evolve through the remainder of the downturn period.⁴³

We are currently in the trough of the long wave economic cycle during which there is an overcapacity to produce almost everything (steel, autos, semiconductors, laid optical fiber, ...). Sterman's description of conditions in the trough match what we are experiencing:

And if you look at how well we are doing by such measures as real wages, we are worse off today than we were twenty years ago. Real wages have been flat since 1973. In addition, the increased duration of unemployment and growing numbers of permanent job reductions in large firms indicate that the deterioration is not cyclical (a manifestation of the business cycle), but is of a much more structural nature.

Such persistent unemployment is a typical symptom of long wave decline. The decline is not the end of the long wave, however. The end of the long wave occurs when the economy has navigated its way through the trough. The trough period is characterized by an economy that is no longer imploding at a significant rate but that isn't improving either. During the trough the economy is going sideways, which is very much the current situation.

Even in the trough, however, there are blips and dips. ... Even during the trough, the business cycle can continue, causing the trough to be somewhat irregular. ... The fundamentals clearly suggest the next long wave expansion cannot occur within the next couple of years [note this was written in 1992], at the earliest, and might be delayed until the latter part of the 1990s. The outcome depends very much on the quality of leadership in the United States and abroad during the next few years. During the trough, we may very well have a business cycle recovery, but, as has occurred since 1991, the rate of real economic growth will likely be anemic compared to typical post-war recoveries: unemployment will remain high, real incomes will not grow significantly, and social and political pressures for change will intensify.

What is the structure of the economy in the long wave decline and how does it effect employment? On this, Sterman wrote:

Structural unemployment, on the other hand, remains a serious problem. As discussed above, the contraction of the economy in the downturn as firms seek to reduce excess capacity generates persistent unemployment. The vicious cycle described above, whereby downsizing caused by firms seeking to gain competitive advantage erodes employment, incomes and confidence, leading to more downsizing and still more unemployment, is intensified as households and businesses reduce their debts. The responses to the persistence of such structural unemployment are inherently slow: migration, retraining, retirement all take time and are disruptive to family and community.

What, then, can we expect during the remainder of the long wave trough? On average, real economic growth

⁴³ Sterman's footnote: "The theory and evidence for the long wave are laid out in a series of papers listed in the bibliography at the end of this paper."

will continue below the long term historic trend. Growth will likely be erratic due to the business cycle. In fact, inventory levels and other short-term cyclical indicators generally suggest the economy should be in the recovery phase of the business cycle. The recovery has been very weak, however, because it is dominated by the downturn and trough of the long wave.

Figure 5 shows the structure described above.⁴⁴ Balancing loop **B1, Downsizing**, shows that individual companies downsize to reduce their “excess capacity” in order that “industry capacity” not exceed current “aggregate demand”.⁴⁵ The problem is that this creates a “side-effect” loop **R2, Economic Vicious Cycle**; after some delay the downsizing itself reduces “aggregate demand” as “expected income” (i.e., consumer confidence) erodes. This is a classic systems thinking archetype, a “Fix that Fails.” A case where individual, boundedly-rational decisions lead to system collapse.

So where are we in the long wave? Sterman wrote:

The period of the long wave is between about 45 and 60 years. It is not clockwork, but rather an internally generated dynamic subject to the influences of other forces in the world. ... The world economy has been in the decline phase of the long wave since the 1970s. The peak of real GNP against trend (the long-term, superimposed exponential increase) was in 1973.

This indicates the bottom of the current long wave should be somewhere between 1996 and 2003,⁴⁶ which would mean we should be pulling out of the trough of the long wave by now.

However, the capacity to supply goods relative to demand is great. *The Chicago Tribune* covered the extent to which this is the case and the impacts in a four-part series of stories on “The economics of glut.”⁴⁷ They summarized:

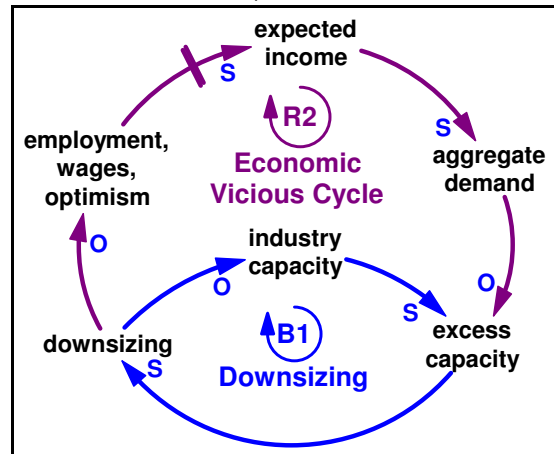
Businesses can produce far more than we need. Supply has simply outstripped demand. When that happens, production slows, equipment sits idle, costs go up, workers are laid off and investments are postponed.

The capacity glut exists on a scale that this country and many others haven’t seen for decades, and it at least partially explains why it is so difficult for the American economy to shake off a recession that by all measures seemed mild.

Unfortunately we do not seem to be pulling out of the long wave trough. The primary likely causes are, first, the speculative investment bubble of the 90s.⁴⁸ It created even more capital expansion at a time when the economy had not yet finished working off excess capacity that’s a natural consequence of the long wave. And, second, tax policy geared to increase supply, not demand.

So it appears likely that a decade of “irrational exuberance” and overinvestment is prolonging our bumpy ride along the trough, which may yet last for another decade, or even longer if the current, inappropriate, economic and tax policies are maintained.

Figure 5. Loop B1 shows that individual companies make rational decisions to downsize to reduce company expenses; this reduces industry and excess capacity. But loop R2 shows the sum of all the downsizing decisions has an overall industry “side-effect” of reducing employment, income, and demand to create even more excess capacity. This economic vicious cycle can lead to overall economic collapse.



⁴⁴ Sterman observes: “Readers trained in economics will recognize the reinforcing feedback loop just described as the ‘Keynesian consumption multiplier.’ During the expansion of the long wave the multiplier feedback helps power the boom, as rising employment, incomes, and optimism lead to more demand and still further expansion. Now the same feedback process runs in the opposite direction, deepening and prolonging the depression.”

⁴⁵ excess capacity = industry capacity - aggregate demand

⁴⁶ $1973 + 45/2 \sim 1996$ and $1973 + 60/2 = 2003$

⁴⁷ *The Chicago Tribune*, December 15, 2002 through December 18, 2002 at:

<http://www.chicagotribune.com/business/chi-021215glut.1.4874700.storygallery?coll=chi%2Dnewsspecials%2Dhed>

⁴⁸ The Federal Reserve, rather than steadily raising interest rates throughout 2000, should have instead increased margin requirements. When speculators look for on the order of 20 - 30% returns in 6 months, they are not deterred by a few percentage points increase in interest rates; only a lessened ability to borrow to fuel their speculation will be effective. In addition, when the speculative bubble did finally burst, the higher interest rates made the collapse even worse. The Fed did abruptly reverse course, but to little effect in the face of such great production overcapacity. With supply greatly exceeding demand, reducing interest rates to promote investment is like pushing on a rope, which works poorly, if at all. However, the much lower interest rates did result in a refinancing boom that reduced mortgage expenses for many Americans and buoyed consumer spending.

♦ Sterman's "Possible Policy Errors"

First, he says, don't "fight inflation," rather flight deflation by keeping interest rates low and providing liquidity.

There is an inappropriate focus by some central banks on fighting inflation rather than providing liquidity to fight deflation and unemployment. ... Inflation is simply not the dominant problem during the long wave trough. Inflation will become a serious threat as the next long-wave expansion gets underway, but that time is not yet here. What we need to do for now is to make sure there is adequate liquidity in the world's financial system so that real interest rates can drop to tolerable levels.

Second, he says, don't try to eliminate the deficit if it means decreasing demand by increasing taxes⁴⁹ or by federal spending cuts.

A second possible policy error has to do with the US fiscal deficit. A tragic error was made in 1982 when President Reagan cut taxes without comparable spending cuts. The resulting stimulus, coming during the peak of the long wave, allowed the economy to grow even further, to generate even more excess capacity, and build up even more unsustainable debt in even more overpriced assets. The consequence: a more severe long wave downturn. Having made that blunder, it would now be a disaster to compound it with aggressive deficit reduction during a time of depression. Eliminating the deficit now, either by taxes or spending cuts, would be extremely contractionary. ... We should not minimize the seriousness of the explosion in Federal debt. The issue is the timing. Attempts to cut the deficit now will be self-defeating as the resulting unemployment and contraction in the tax base will further erode revenues and boost spending on social programs such as unemployment compensation so that the deficit will not in fact fall.

While the deficit cannot now be cut, I do believe much Federal spending could be shifted away from relatively unproductive Federal expenditures in both military and social programs into more productive, investment-oriented areas. There is a lot of room for reallocation of funds to rebuild the social fabric of our society and improve the quality of our lives. The federal government should adopt a capital budget,⁵⁰ in which investments in infrastructure, including human capital (e.g. education, preventive medicine) are separated from operating funds. Such programs should be counted as investments in the future of the nation, not expenditures contributing to an operating deficit.

Third, he says, avoid protectionism.

A third policy error is protectionism. The long wave is synchronized globally. The linkages among nations through trade and capital flows are strong enough to synchronize the long wave across national boundaries, although there are some variations in the timing of the short-term business cycle. The US downturn started in 1990, Germany's is underway, Britain and Canada started to slide a year before the US. Currently, the entire industrialized world is in decline. Obviously, all nations cannot simultaneously buoy up their domestic economies by boosting exports at the expense of their trading partners. The experience of the Depression shows clearly that beggar-thy-neighbor trade policies lead to trade wars that shrink aggregate demand for all nations and intensify the downturn. Despite the free trade rhetoric, the past decade was the most protectionist since the Great Depression — even though the world economy was growing. As the long-wave trough continues, protectionist pressures will surely intensify.

It should be observed regarding protectionism that, relative to this third policy error, other countries are "boosting exports at the expense of" the U.S. as a trading partner. As noted in an earlier section, the trade deficit cannot continue to grow exponentially. Such a negative balance of trade shows the U.S. is not protectionist. It also shows we need a level playing field and need to stop "reverse protectionist" policies noted above.

Finally, his most important concern is for government to not abandon the powerless and tear the social fabric beyond repair, which is the trend of current policies.

The most important possible policy errors have to do with the political shifts discussed above. During a time of growing parochialism, the forces of demagoguery and division that threaten our society must be opposed. Over the past twenty years, since the long wave peaked and began to decline, real incomes have fallen. Income inequality has increased. Social tensions among racial and ethnic groups have risen. Further erosion of the social safety net would be extremely divisive. Social policies that increase inequities would have very damaging effects. The depression is a time to pull together, to build bonds of community, to reach out to others. It is the right thing to do. If we fail, if we shrink from our neighbors, if we allow government to abandon the powerless, the social fabric might tear beyond repair.

⁴⁹ I would qualify this by noting that the Clinton tax increases on the higher brackets in 1993 did not significantly reduce demand, but allowed the Fed to rationalize keeping interest rates low. Current policies to increase capacity will, as he notes result in a more severe long wave downturn.

⁵⁰ With all the calls for "running government like a business," it's somewhat amazing the U.S. does not have a capital budget.

5. The theory of comparative advantage is not a valid justification for “free trade” policies that promote the transfer of the factors of production, not simply trade in products. Therefore, policies should not be formed using it as a rationale.

- ♦ “Comparative advantage” says that when everyone does what they do best and trades, then everyone benefits. However, trading products is “trade,” but moving the “factors of production” that produce the products is not within the scope of simple trade; it is “economic migration.”

Paul Craig Roberts in a column in the *Washington Times* succinctly describes the theory of comparative advantage:⁵¹

The gains from trade flow from each country focusing on what it can do best and trading for other goods. The idea that there are comparative advantages in production is based on countries having different endowments of immobile factors of production. When the theory was developed, agricultural output was an important component of gross domestic product, and a country’s advantages resided in its climate and geography.

He observes that trading products is “trade,” but moving the “factors of production” that produce the products is not within the scope of simple trade covered by the theory of comparative advantage:

Economists mistake the free movement of factors of production for free trade. Raised on the theory of comparative advantage, economists know that free trade is mutually beneficial. They dismiss without thought any concerns that seem to call free trade into question. The case for free trade has been unassailable for so long that economists have overlooked that today’s circumstances do not comply with the assumptions of the theory. ...

David Ricardo discovered the principle of comparative advantage in the early 19th century. He recognized that the principle did not hold if all factors of production are internationally mobile. Mobile factors of production would migrate to countries that had the greatest absolute advantages. Those countries would gain and all others would lose. ...

Today, absolute advantage resides in an abundant supply of cheap and willing labor. Now that Asia is safe for capitalism, capital and technology flow to countries where labor costs are lowest. ... American labor now faces direct competition in global labor markets. The excess supply of labor in these markets will drive down wages, salaries and employment in the United States. As the dollar is likely to lose value under pressure from our growing trade deficit, the decline in wages will not be compensated by a decline in prices, and U.S. living standards will fall. ...

Economists dismiss as “anecdotal evidence” the news reports of millions of high-paying U.S. white-collar jobs being moved overseas and filled by foreigners. American high school and college students are far more realistic than economists as they search for careers that cannot be shipped out or given to foreigners on work visas.

U.S. labor no longer has the advantage of education, training, technology and capital over its foreign competition. Existing wage levels, however, assume that Americans still have these advantages. The extraordinary wage differences between the United States and Asia mean that jobs will flow out of the United States into Asia. Tax cuts and low interest rates cannot compensate for the huge wage differences.

American corporations have made a strategic decision to move jobs abroad. What corporations will employ the displaced U.S. employees?

- ♦ That companies will migrate to locations with the greatest “absolute advantage” is explained by the systems thinking archetype, “The Attractiveness Principle.”

That all business will flow to the place that has absolute advantage is related to the systems thinking structure, or “archetype,” called the “attractiveness principle.”⁵²

The primary lesson of the structure is that, for example, no business can be “all things to all people.” Each business must choose among the factors that make its business more attractive and focus on the ones that define “what it wants to be.”⁵³ To illustrate, all restaurants know they cannot (at the same time) be the best at everything: McDonald’s, Outback Steak House, and the Broadmoor all make different choices. Any business that attempts to have the highest quality product, the lowest cost and the best service (e.g., delivery time) fails because it’s overwhelmed on at least one of these dimensions.

People allocate business to the different restaurants based on their individual perception of restaurant

⁵¹ Paul Craig Roberts, “Seeking jobs in the U.S.A.,” *Washington Times*, Wednesday, August 6, 2003. <http://www.washtimes.com/commentary/20030805-084100-3722r.htm>.

⁵² Note that “attractive” does not mean “pretty;” it means the composite influence of factors that attract. The Attractiveness Principle is a systems thinking archetype; the archetypes are fundamental structures that are frequently seen in systems. The word comes from the Greek archetypos, meaning “first of it’s kind.” *The Fifth Discipline* by Peter Senge (1990) describes many of the common archetypes, but not this more complex structure. For more on this see the *CIA* paper on “The Attractiveness Principle.”

⁵³ An inability to focus in this way has caused the failure of many companies; K-Mart is often mentioned in this regard.

composite attractiveness. A restaurant that gets more business than it can handle suffers a decline in service or seating delays that makes it less attractive (or it may raise prices to reduce demand and increase profit). Some people will therefore go elsewhere to more “attractive” restaurants (for them).

This dynamic also applies to geographic regions. The behavior described in the previous paragraph is captured by a corollary to the attractiveness principle:⁵⁴

Given free migration, no place can long remain more attractive than any other place. ... Population growth continues until negative pressures arise to counterbalance an area’s underlying attractiveness.

This makes sense; people flow from places that are less attractive to places that are more attractive until negative pressures arise that make the places to which they are moving *just as unattractive as the place from which they are coming*. It’s the same kind of phenomenon as water seeking its own level.

This structure, this economic “fact of life,” applies to job loss to countries such as China. Given free migration of the factors of production (labor, capital, and land),⁵⁵ they will move from the U.S. to other places, such as China, as long as they are places of greater composite attractiveness.

Because China, India and other relatively undeveloped countries have a virtually inexhaustible supply of cheap labor, with many of them highly educated as well, this “economic migration” of the factors of production will go on for decades, if not the next century.

Because world conditions do not meet the constraints of the underlying theory of comparative advantage, upon which “free trade” advocates rely, conclusions drawn from the theory are flawed.

- ♦ A great many, perhaps even most, economic clusters have not formed because of comparative economic advantage; they were formed due to “accidents” or protected from competition or even government-subsidized.

Paul Krugman explained the essential feedback nature of economic clusters in describing the formation and evolution of industrial clusters:⁵⁶

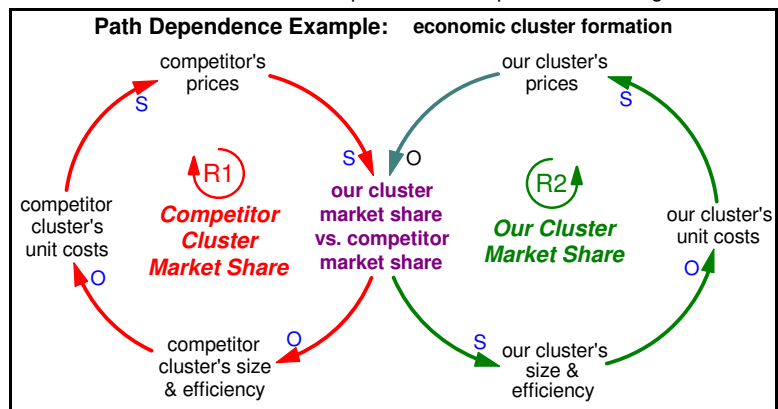
The whole process of industrialization within the United States was marked by ... small accidents leading to the establishment of one or two persistent centers of production. ... What is important ... here is ... not the initial accident but the nature of the cumulative process that allows such accidents to have large and longlasting effects. ... there is a circularity that tends to keep a geographic cluster in existence once it is established.

The circularity to which he refers is a positive (reinforcing) feedback that results in exponential growth of a cluster in one location, instead of another location. Once a cluster in one region “gets ahead” of another cluster in composite attractiveness by having a more efficient ecology of suppliers, customers and similar companies, it will continue to get even more ahead. This is the growth side of the path dependence structure shown in Figure 6, which is known as the systems thinking “Success to the Successful” archetype.

The dark side of this structure is that, if for some reason a cluster (or economic region) becomes less attractive overall than another cluster, it suffers exponential decline, instead of growth.

Adding to this, many clusters were not “accidents” at all; rather they were initially government supported (e.g., silicon valley), subsidized and protected until they achieved the economies of scope and scale that they enjoy today.

Figure 6. Once an economic cluster gets ahead, often by some economic “accident” or government support, it tends to stay ahead because larger clusters are more efficient. Lower transportation costs promote cluster growth.



⁵⁴ Louis Alfeld, “Urban Dynamics — The First Fifty Years,” *System Dynamics Review*, Fall 1995

⁵⁵ Of course, land cannot move, but as long as there is substitutable land, land in one country can be substituted for land in another, just as labor in one country can be substituted for another.

⁵⁶ Krugman, P., “Location and Competition: Notes on Economic Geography.” In Rumelt, Schendel, & Teece, *Fundamental Issues in Strategy - A Research Agenda*, Harvard Business School Press, 1994

Therefore, many clusters are not located where they are because of the free market theory of “comparative advantage” and “free trade” policies that justify and promote the transfer of the factors of production should not be formed using it as a rationale.

- ♦ The benefits of policies that promote trade are not spread evenly. There are winners and losers and the losers are not compensated. Even retraining is paid for by the public at large, not by the winners.

Lester Thurow (1996, p. 69) explains:

The classical theory of comparative advantage is often taught as if everyone benefits from trade. Technically that is not true. The total income of every country that takes advantage of comparative advantage grows, but there will be individuals within each country who lose. What the theory holds is that those who gain from international trade receive enough extra income from their activities that they could compensate those who lose when international trade commences. If that compensation isn't actually paid (and it almost never is), then those who lose are quite rational to oppose international trade.

In addition it might be noted that even when there is government support of programs for worker retraining, it is not the winners that foot the bill, it's the public at large through taxes.

- ♦ The requirements of the classical theory of comparative advantage are not met.

Lester Thurow (1996, p. 69, 70) explains:

But in the classical theory the losses usually will be quite small. **First**, full employment is assumed to exist.⁵⁷ Free trade does not push anyone into unemployment. **Second**, transition costs are assumed to be zero. There is no region-, industry-, or firm-specific physical or human capital that is destroyed when workers are forced to shift between regions, industries, or firms. **Third**, returns are assumed to be everywhere equal. Each industry has the same rate of return on human or physical capital. Each firm and industry pays the same wage rate for a worker's being willing to give up an hour of leisure. As a consequence, being forced to shift jobs doesn't change wages very much, if at all. ...

This set of beliefs led to what are now the immortal words attributed to the chairman of President George [H.W.] Bush's Council of Economic Advisors, Michael Boskin: "It doesn't make any difference whether a country makes potato chips or computer chips."⁵⁸

But none of these assumptions is of course true. Trade can cause unemployment. Those who lose their jobs when imports expand often remain unemployed for long periods of time. Theoretically, governments could stimulate their economies to prevent higher unemployment but they often don't. There are transition costs in moving people between regions, industries or firms.

So it's worth saying again, because world conditions do not meet the constraints of the underlying theory of comparative advantage, upon which “free trade” advocates rely, conclusions drawn from the theory are flawed.

⁵⁷ Lester Thurow notes that our “official count” is an extraordinary underestimate; it does not count those who do not meet any of the tests for being active in the workforce and are therefore not considered unemployed, part-time workers who would like full-time work, illegal aliens, the contingent workforce of underemployed people in temporary jobs, or those who work “on call,” self-employed “independent contractors” (“many of whom are downsized professionals who have very few clients but call themselves self-employed consultants because they are too proud to admit that they are unemployed”). Lester Thurow, “The Crusade That's Killing Prosperity,” *The American Prospect*, March-April 1996, pp. 54-59. <http://www.prospect.org/print/V7/25/thurow-1.html> .

⁵⁸ Thurow endnote: “Professor Boskin denies that he ever made any such remark but it will go down in history as his most famous remark regardless of whether he did or did not actually make it.”

VI. Can government take action to slow or reverse the loss of manufacturing? Yes. Should it? Yes.

1. Change the mindset that “Government has done all it can do.”

At the 2003 Colorado Innovation Summit,⁵⁹ Opening Remarks at the conference were by John Hansen, Colorado Secretary of Technology. Mr. Hansen’s attempt at an upbeat speech to innovators and entrepreneurs was to say words to the effect, “It’s up to you, go to it, take risks, you can do it ... go get ‘em.” He said, “Government has done all it can do.”

This is an unfortunate and unproductive belief, because there are many things that government can do to promote growth, create jobs in the U.S., and reduce the exodus of jobs from the U.S.

Perhaps more importantly, there are many things the U.S. *can stop doing* so as to *not drive jobs out of the U.S.* Current policies that fall in this category could be described as a form of “reverse protectionism.”

Note, stopping “reverse protectionism” is not protectionism. Examples of reverse protectionism:

- The Federal Reserve Board setting excessively high real interest rates (in the recent past).
- Allowing other countries (e.g., China) to manipulate and undervalue their currencies to maintain trade advantages.
- Giving investment tax credits to companies that do not keep their complementary assets (e.g., manufacturing) in the U.S., because the nation subsidizes the innovation, but does not fully profit from the innovation.
- Not including environmental standards in trade pacts creates a uneven playing field by allowing countries that do not respect environmental standards and mortgage their long-term future for short-term gain.⁶⁰
- Not including labor standards in trade pacts creates a uneven playing field by allowing countries that do not respect labor standards burden their population and mortgage their long-term future for short-term gain.⁶¹
- Trading with countries that lower taxes to the point that they mortgage their long-term future for short-term gain.
- Allowing corporations to engage in flawed transfer pricing schemes to avoid U.S. taxes.
- Allowing corporations to move headquarters out of the country to avoid U.S. taxes and yet still perform government contracts.

Considering the growing U.S. trade deficit, it’s clear that the U.S. does not have a problem with “protectionism” and that, to the contrary, “reverse protectionism” is winning.

This paper contains a partial list of things government can do, and *stop doing*, with supporting rationale and references.

2. Not only can government do something, it’s an essential and appropriate role for government to take action, because it’s to the advantage of no one company or group of companies to bear the burden of doing so.

Expending effort to promote networks and economic clusters has “positive externalities.” That is, the effort helps all companies, not just those that expend the effort. Companies that do not incur the costs will reap benefits; they will “free ride” on those who do make the effort.

Therefore, it’s an appropriate role for government because otherwise some companies will bear the burden and others will “free ride.”

3. Government must be the entity that takes a long-term focus, because the focus in the private sector is primarily short term. Only government can create effective incentives to reinforce a long term focus and effectively represent the future to the present.

Lester Thurow addresses the need for government focus on the long-term (Thurow, 1996, p. 295):

By default in an era of man-made brainpower industries, government will have to play a central role in supplying the three inputs — human skills, technology, and infrastructure — that will determine the success or failure of twenty-first century capitalism. Each of the three is needed, yet spending on each is falling. Capitalism isn’t getting what it needs for its own long-run success.

In an era of man-made brainpower industries, the purpose of government is clear. It should be representing the interests of the future to the present. It should be making the necessary investments that capitalism

⁵⁹ Denver, CO, 7/18/03, Cable Center on DU Campus. My presentation was on “Using Systems Thinking to Profit from Innovation.”

⁶⁰ The argument that countries should be free to value their own environment only holds if they are democracies with the technical ability and financial resources to properly value and monitor the environment. The environment is a public good (a commons) for which only governments can set the value, not individuals or “the market.”

⁶¹ Doing so allows countries to lower labor standards to shift the gains of trade to a relative few and shift the costs of trade (in negative impacts on health) to the many. Again, only democracies with the technical ability and financial resources can properly value and monitor public health.

cannot make for itself, but it isn't. Instead government is doing exactly the opposite. It is borrowing from the funds that could be used for investments to improve the future to raise today's consumption for today's citizens.

The Right Place Position Paper notes (Right Place, 2002, p. 75) that:

Typically, it is at the applied R&D stage that the risk/reward ratio improves to the point that private companies are willing to begin to make R&D investments in the hope of translating them into commercial advantage.

While industry typically concentrates the majority of its research and development on its own products and services, more recent history has also seen a reduction in the level of risky, long-term research investments by private industry, and a greater focus on short-term return.

The Industrial Research Institute's "R&D Trends Forecast for 2002" noted that R&D among its membership (which represents 70 percent of all the industrial R&D done in the country) "continues to be tightly targeted for tangible business results," including less participation in pre-competitive consortia, fewer contacts with federal labs and fewer grants and contracts to universities.

The primary reason for this is that a short term focus in companies is encouraged by Net Present Value (NPV) and Internal Rate of Return (IRR) calculations. A 20% to 30% IRR "hurdle rate" significantly devalues profits in out-years and discourages investments that yield returns over the long run, but not in the short run.⁶² These calculations do not effectively represent the future to the present (see Net Present Value Examples).

There is, in general, a short term focus in organizations (see the quote from Arie de Geus), for which there are many reasons, including:⁶³

- Pressure by Wall Street calling for quarterly and annual earnings growth.
- CEO compensation packages based on short-term incentives, etc.

For example, government can punitively tax speculative short-term capital gains and require very long-term vesting of options.⁶⁴

Net Present Value Examples

To look at the result of using net present value calculations, take an example of preserving something, say parkland, that would be worth one billion dollars (\$1,000,000,000) to the public 100 years in the future.

At a 20% discount rate, that \$1B value is only worth \$12.07 today ... hardly worth saving.

A value of one trillion dollars 100 years in the future at a 30% discount rate is only worth \$4.03 today.

We should not be surprised ... that so many managers have so little time to think because they are constantly engaged in firefighting. To me, this prevalence of mishap is a strong argument for running our companies with the same low tolerance for error in management that we currently employ in the more technical parts of the business. As many, if not more, human fates ride on the quality of management's decisions in a takeover, merger, plant closing, or product change as there are at risk on a North Sea platform or inside a Boeing 747. ... We should not be so willing to take more risks in nontechnical work simply because the results of our errors are less immediately violent.
Arie de Geus, *The Living Company*, 1997, p. 66

⁶² That said, NPV and IRR calculations feed, but are not entirely responsible for the addiction to the "quick fix" in organizations that exactly parallels an individual's addiction to drugs. It's much easier and faster go to after cheap labor than increase operational effectiveness or develop additional high-value products. See the series of *CI* papers on "The Crisis Syndrome," "Escaping the Crisis Syndrome" and "Crisis Syndrome Recovery."

⁶³ Suggested by Jim Leonard.

⁶⁴ Suggested by Paul Carson.

VII. Here's what government can do.

1. Fund and actively promote economic clusters and societal networking.

◆ Why promote clusters and societal networking?

The Right Place's "Manufacturers Council Position Paper" (Right Place, 2002) explains that it's important to promote Economic Clusters:⁶⁵

- "Place Matters: Innovation diffusion is enhanced by geographic proximity."
- "Drive strategies to strengthen regional clusters of innovation."

The Right Place paper is correct to emphasize economic cluster formation; creating initiative to foster economic clusters is the most important thing government can do.

◆ Here's how to promote economic clusters.

As noted in an earlier section, what Krugman describes as a "circularity" is, in system dynamics terminology, reinforcing feedback. To understand how to foster clusters, we must understand the dynamic reinforcing feedbacks in the system and design policies and actions that promote growth.

Figure 7 shows a few of the central feedbacks in an economic cluster. A more complex model is included in Appendix A. The Major Loops are:⁶⁶

Language Notes

S: Influence in the **S**ame direction

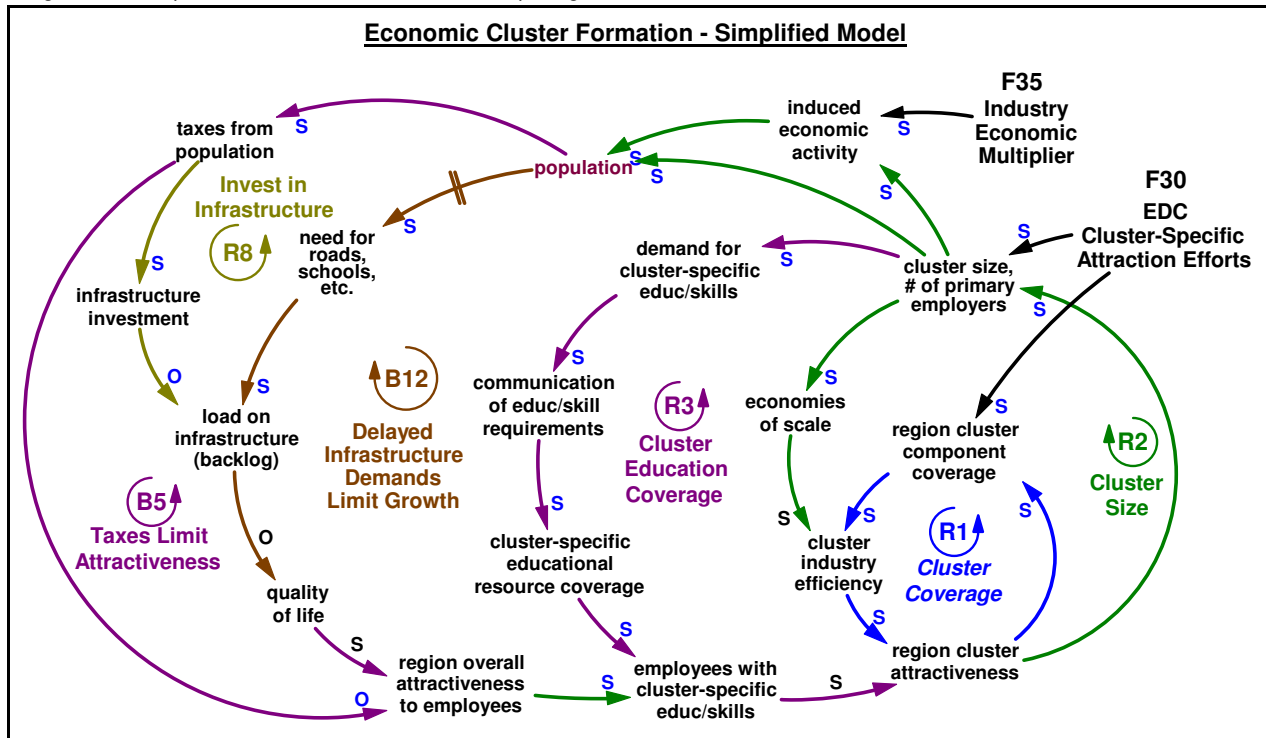
O: Influence in the **O**pposite direction

R: **R**einforcing Loop (positive feedback): action is increasing or decreasing (i.e., a virtuous or vicious cycle)

B: **B**alancing Loop (negative feedback): action is goal-seeking (e.g., a thermostat)

Definition: "region cluster component coverage": the extent to which a cluster is a "complete ecology of companies;" i.e., it contains the suppliers, customers and like companies needed to support an efficient, effective, adaptable, & creative cluster.

Figure 7. A Simplified Economic Cluster Causal Loop Diagram



R1: Cluster Coverage - The greater the "region cluster attractiveness", the more other cluster companies will locate and/or expand in the region, especially with the EDC focusing its attraction efforts on missing cluster components. This increases "cluster industry efficiency" and further increases "region cluster attractiveness".

R2: Cluster Size - The greater the "region cluster attractiveness", the larger the "cluster size" and the greater the "economies of scale" that increase "cluster industry efficiency" and increase "region cluster attractiveness".

⁶⁵ Right Place, 2002, pp. 7, 8, 55, 64, 84, 93, 96-101. Economic clusters include companies, suppliers and customers to create economies of scale.

⁶⁶ These selected loops illustrate a major systems point made by Jay Forrester, when he wrote, "There are no utopias in social systems." R1, R2, & R3 are feedbacks that promote growth in cluster size, but nothing grows forever. The increased infrastructure load creates a feedback, B12, that limits growth. This can be overcome by taxes for infrastructure, but taxes are unpopular and this again limits growth. It's a Gilda Radnor world: "There's always something."

R3: Cluster Education Coverage - the greater the “cluster size”, the more cluster-specific educational resources will be developed to increase the number of employees with cluster-specific education to further increase “region cluster attractiveness”.

B12: Delayed Infrastructure Demands Limit Growth - The greater the cluster size, the greater the population load on the infrastructure: more traffic, crowded schools, and inadequate public transportation. This reduces “region overall attractiveness to employees” and limits the number of employees available.

R8: Invest in Infrastructure - To address the infrastructure backlog, taxes can be used for “infrastructure investment” and allow continued growth.

B5: Taxes Limit Attractiveness - However, the greater the “taxes from population” the less the “region overall attractiveness to employees” and limits the number of employees available.

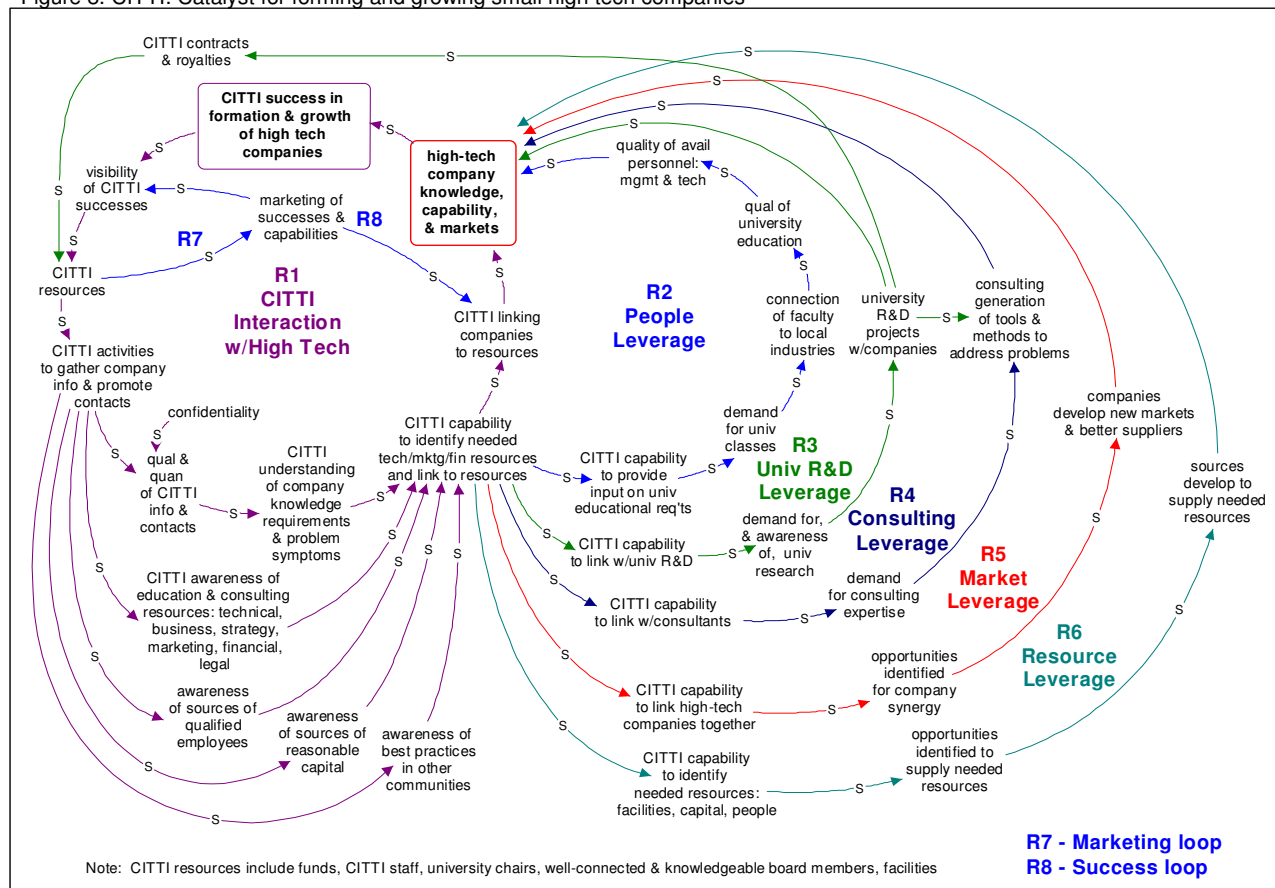
◆ Here’s how to promote societal networking.

A concept related to cluster formation in the Right Place Position paper is Societal Networking:⁶⁷

“The benefit and means of sharing good management practices with others, so all can improve more rapidly.” It creates “... a dense web of relationships that allows companies to network with each other and share non-proprietary best practices.”

Figure 8 shows a diagram developed to show the feedbacks that can promote societal networking for the formation and growth of high technology companies.^{68 69 70}

Figure 8. CITTl: Catalyst for forming and growing small high tech companies



⁶⁷ Right Place, 2002, p. 55

⁶⁸ This causal loop diagram of CITTl (Colorado Institute for Technology Transfer and Implementation) was developed in 1998 with the assistance of Gene Warrington, a CITTl board member. The diagram was not specific to what CITTl was actually doing, but about the different feedback loops that *could* foster, and are chosen to foster, growth in the effectiveness of CITTl’s mission. Such diagrams can be used to develop a shared understanding of the reinforcing processes that could help fulfill CITTl’s mission and help define the specific activities and actions to promote the functioning of those feedbacks. How to make practical use of causal loop diagrams is described in the *CPA* paper, *From Causal Loops to Action*.

⁶⁹ A barrier suggested by Tom Daschbach, Tdaschbach@aol.com, (formerly at the Chamber of Commerce, responsible for the manufacturing group) is that companies headquartered elsewhere are very reticent to share information and best practices.

⁷⁰ Another reference from Jim Leonard: Networking between disparate communities promotes innovation. See Andrew Hargadon, *How Breakthroughs Happen*, HBS Press, 2003.

2. Inform companies of the hazards of moves offshore to countries such as China.

There's a role for government here because companies that are in business to sell companies on outsourcing may not see it as in their interest to fully reveal the downsides. Government can present data, examples and case studies to companies that illustrate the disadvantages and pitfalls of outsourcing. This need not be done simply to discourage moves, but to encourage a realistic appraisal of such moves, improve company profitability and stability, and protect the tax base.

- ♦ Outsourcing is not a reliable competitive advantage. Expected cost reductions are often not achieved; supply interruption and quality risks often outweigh rewards.

Examples are abundant. Here are a few:

- **HBR paper on "What Really Works":** The July 2003 *HBR* paper on "What Really Works" (Nohria, 2003) is on a five-year empirical study that reveals the must-have management practices that truly produce superior results. From the section on **Execution**, the finding that there was no correlation between outsourcing and financial performance may be surprising to many companies that outsource, or are considering outsourcing:

As with strategy, it's not what you execute that matters but how. We found no relationship between the degree to which a company embraced outsourcing, for instance, and its financial performance. Nor did success hinge on the extent to which a company invested in specific ERP, CRM, or supply chain management technologies and systems. That's not to say these tools and techniques aren't useful or productive; it's just that embracing them won't necessarily catapult your company to the head of your industry. Disciplined attention to operations is what really counts.

- **Goodrich Aircraft Interior Products:** In the 8/06/03 Manufacturing Task Force meeting, Goodrich gave an example where they tried outsourcing to Taiwan. No parts met specification and they abandoned the attempt.
- **Jim LeDoux, Consultant:** At the Rocky Mountain Denver Product Development and Management Association (RM PDMA) meeting in Denver on 4/16/03,⁷¹ Jim LeDoux,⁷² a consultant who helps companies improve project management and manufacturing, noted that many companies are bringing their production back to the U.S. from China because, they find, outsourcing to China brings too many quality problems and too much risk.

When there are product failures, the cultural and communications problems make the problems very difficult to solve. There are so many restrictions that they can't even go down on the shop floor to see what's happening to their product, much less help solve the problem.

Companies find they don't save much after adding in the costs of travel, delays and product failures. So when they look at the potential risk of shutting down their entire business, outsourcing doesn't pay. Beyond that, he says their cultural tendency is to be "laid back and patient" and they're generally not in a big hurry to solve the problems. Patience is a good quality, but this source finds they lack urgency when it's needed.

- **Intel:** Jeff Murray, in a Manufacturing Task Force Meeting, noted that highly vertically-integrated Intel has invested heavily in promoting communication and coordination between engineering and manufacturing among locations all over the world because tight coupling is vitally important.⁷³
- From a Society for Manufacturing Engineers' Lean Directions e-Newsletter article:⁷⁴

Onsite Manufacturing is a Lean Strategic Advantage

Nielsen-Kellerman (NK) is a small manufacturer of specialized electronic equipment headquartered in Chester, PA, a suburb of Philadelphia. Its at-home manufacturing capability is at the heart of its lean strategy, enabling the company to respond quickly to changing demand, easily manage a large number of product configurations, quickly make changes and improvements in the products, and fix problems as they arise. ...

NK faces significant European and Far Eastern competition in handheld weather instruments. Despite this, and despite the fact that direct manufacturing costs (materials, labor, and overhead) account for a substantial portion of total sales, NK does all its manufacturing in Pennsylvania and has no plans to

⁷¹ The program was my presentation on "Surviving Disruptive Technologies and Thriving with Practical Systems Thinking"

⁷² Alpha Group 3, alphagroup3.com, jamesL@alphagroup3.com

⁷³ "Jeff Murray" <jeffrey.j.irl.murray@intel.com>

⁷⁴ September 9, 2003 Issue, By Peter Johnston, Delaware Valley Industrial Resource Center, Philadelphia (<http://www.dvirc.org>), <http://www.sme.org/cgi-bin/get-newsletter.pl?LEAN&20030909&1>

attempt to reduce costs by taking it elsewhere. ...

On several occasions the company has done a detailed costing for offshore manufacturing of its Kesrel line of weather products, but each produced the same conclusion: projected savings would be far too low to justify the risks, loss of control, and loss of flexibility.

One problem is that these products use critical components that are not available locally in China and thus would be no cheaper there than here. In addition, for a company the size of NK, Chinese manufacturing would involve U.S.-based middlemen whose commission would erode the margins. NK does use Chinese vendors for some of its molded parts and circuit boards, and all of its liquid crystal displays, and has had enough problems in all three areas to further discourage it from transferring the entire manufacturing process. ...

NK has managed to take a necessity — on-site manufacturing for at least some of its products — and turn it into a strategic asset by following some basic principles:

- By intent, NK deals in relatively low-volume products for demanding markets.
- Products are designed up front for minimum labor, and with the plant's cellular production environment in mind.
- The company patents and copyrights as much of its work as possible, and vigorously defends its intellectual property.
- It seeks markets in which the ability to be efficient in small and mid-volume production is an asset.
- It has integrated its suppliers (more or less successfully) into its pull/kanban system (see below). Most of the vendors now ship against a blanket order with releases triggered by fax, not by a release schedule. Almost all vendors hold inventory, or, at their discretion, can make material for NK within the required lead time.
- Above all, the manufacturing operation is flexible. It can profitably make some products in volumes of 20,000 a year, others at a few hundred a year.

... Leveraging manufacturing capability as an asset allows Nielsen-Kellerman a degree of control over its operation that would be impossible with outsourced manufacturing. It enables the company to respond quickly to changing demand, easily manage a large number of product configurations, quickly make changes and improvements in the products, and fix problems as they arise.

It does something else as well. "We enjoy making things," Richard Kellerman says. "We feel there is intrinsic worth in that, and we are not particularly comfortable with the prevailing economic wisdom which dictates that the U.S. can no longer compete in manufacturing."

♦ **Companies selling to China often create their own competitors.**⁷⁵

China's growth as a production base has followed a consistent pattern: A new product is introduced, usually by a foreign company. Within months, numerous local Chinese manufacturers also start cranking it out. Prices slide and producers, both foreign and Chinese, start looking for new markets, increasingly overseas (e.g., in the U.S.). (Right Place, 2002, p. 40).

♦ **Many companies who expect to sell to Chinese markets are disappointed because worker income is insufficient to purchase the products.**

Many companies that go to China with the intent of selling into the Chinese market discover that there is very little demand due to the low income structure, and instead shift to exporting from China to other markets. (Right Place, 2002, p. 40)

3. Help companies improve operational excellence.

Government can present evidence to companies that emphasizes that operational excellence is a vital foundation and that the potential for improvement is largely unachieved.⁷⁶ The market "winners" excel at operational excellence.⁷⁷

Government can more actively assist companies in improving operations. Government initiatives include the Manufacturing Extension Partnership (MEP) through NIST (Colorado MAMTC), but support has been small compared to the need.⁷⁸

⁷⁵ Jim Leonard notes: "They need to develop methods of operating in these countries that will protect their intellectual property (IP). Not easy to do if the target country is intent on stealing your IP. The IP that provides critical competitive advantage absolutely must stay at home. But this is easier said than done. Many companies don't know what their real competitive advantages are. If they aren't using some form of activity-based accounting (activity-based costing, ABC), they most likely don't know."

⁷⁶ See the *CI.A* papers on [Facilitating Group Action](#) and [Exponential Improvement](#) at [exponentialimprovement.com](#)

⁷⁷ Organizations can improve operations through "exponential improvement" of all end-to-end "process-complete" processes. The goal is to shift from rewarding individuals for great "fire fighting" to rewarding individuals and teams for "fire prevention." Then companies must build on this with systems thinking to optimize the whole, not just the parts, for even greater advantage; that is, to go beyond "doing things right" to "doing the right things." See the paper [Exponential Improvement](#) at [exponentialimprovement.com](#).

⁷⁸ Comment from Jim Leonard:

"The Federal government is doing this with the Manufacturing Extension Partnership (MEP) through NIST (Colorado MAMTC). Since its inception in approx.. 1992, the MEP has helped thousands of small and midsized manufacturers. However, the impact has

- **From the *HBR* paper on “What Really Works” (Nohria, 2003):**⁷⁹

To be a steady winner, a company must increase its productivity by about twice the industry’s average. During our research period, the mean productivity growth across all industries was about 3% per year; the winners in our study increased their productivity by 6% to 7% every year.

And what works is focusing on improving the productivity of the processes that matter:⁸⁰

Winning companies are realistic. They recognize that there is no way they can outperform their competitors in every facet of operations. So they determine which processes are most important to meeting their customers’ needs and focus their energies and resources on making those processes as efficient as possible. They take the same critical eye to product and service quality as well. Evergreen winners deliver offerings that consistently meet customers’ expectations, and they’re very clear about the standards they have to meet. But they don’t necessarily strive for perfection — unless perfection is explicit in their strategic value proposition, as it is at Federal Express and Tiffany. In fact, fully one-third of our winning companies offered only average product quality. Which goes to show that many customers don’t care about a level of quality that goes beyond their needs and desires; they won’t necessarily reward you for exceeding their expectations. They will, however, punish you severely if you don’t meet their expectations. You tumble quickly when you fail on execution.

- **From the *HBR* paper on “Uncovering Hidden Value in a Midsize Manufacturing Company” (Ash-ton, 2003):**

That’s because - and this is our second general point - operational excellence at the business-unit level is fundamental to our prescription for success. What? Operational excellence? During the past 20 years, haven’t U.S. companies achieved this, or at least come pretty darn close?

Well, that hadn’t been our experience. While many companies may have improved their operational performance in certain areas - for example, product quality and reliability - most still have a long way to go. Continuing this improvement in other areas that contribute to customer satisfaction - such as customized design, improved lead time, and comprehensive technical support - can give them a tremendous competitive advantage. If a company’s existing business doesn’t have a firm foundation of operational excellence, any initiatives to protect that business, to further penetrate existing markets, and to extend and diversify the business are likely to prove mediocre at best and disastrous at worst.

Time and again, we have seen companies that hadn’t achieved the operational excellence needed to allow their existing businesses to hum along without undivided management attention. Consequently, when the companies started venturing into new areas, their core generators of revenue began to sputter. ...

We have found, though, that even unpromising-looking businesses may have promise. That’s because most businesses are still a long way from being all they can be, and they can usually benefit from operational improvements. In fact, dubbing a business not worth saving usually turns out to be a self-fulfilling prophecy.⁸¹

While supporting improvements in operational excellence, government must also be aware of the “dark side” of productivity improvement: less labor is required and layoffs will result unless sales increase proportionately. Therefore emphasis on operational excellence requires an even greater emphasis on support for innovation, even greater because the delays associated with increasing innovation are longer.⁸²

4. Tailor tax policies to tie corporate compensation to, and reward, long-term improvement.

An article with suggestions is “How to Tie Pay to Goals, Instead of the Stock Price.” Excerpt:⁸³

While corporate boards struggle to answer that question, professional experts on executive pay, as well as academics who study incentives, offer some guidance. Many recommend granting stock, especially with restrictions on its future sale, instead of granting options. Some suggest promoting loyalty and performance by

been small compared to the need. Colorado MAMTC has helped many companies since 1993, but most have been small, low-tech companies. Their impact on the Colorado mfg. sector has been small.

“NIST also promotes operational excellence by encouraging companies to participate in the Baldrige National Quality Award competition. In its early years (late 80s, early 90s) the program was very successful. Participating in the process is an excellent way to improve overall competitiveness and operational excellence. These days very few companies participate in the Baldrige competition. The same is true of Industry Week’s America’s Best Plants competition. Participation in the Best Plants competition is generally approx. 200 entries per year. It’s free, but doesn’t provide the detailed feedback that Baldrige participants receive.”

⁷⁹ Another reference from Jim Leonard: *Execution: The Discipline of Getting Things Done* by Larry Bossidy and Ram Charan, Crown Business, 2002

⁸⁰ The “Balanced Scorecard” approach defines measures of each of these capabilities (they say “levels”) to confirm that the feedback is indeed a virtuous cycle. These feedback and value chain considerations are described in detail in the *CI* paper [Create Strategic Focus](http://www.exponentialimprovement.com) at [exponentialimprovement.com](http://www.exponentialimprovement.com).

⁸¹ Comment from Jim Leonard: “This is great information. But how many small and midsize company CEOs take the time, or have the time, to read it and seriously consider such info. This is the place where credible, honest consultants can really help. Also the place for MEP, MAMTC, etc., but it’s not happening fast enough. Or the MEP agents are carrying the wrong messages.”

⁸² Innovation generally has greater organizational and technical complexity than manufacturing. See (Powell, 2002a) in the section on “Combined Exponential Improvement & The Quality Improvement Paradox.”

⁸³ “How to Tie Pay to Goals, Instead of the Stock Price” By DANIEL ALTMAN, New York Times, 9/08/02, <http://www.nytimes.com/2002/09/08/business/yourmoney/08COMP.html>

tailoring executives' packages to their personal tastes — within reason. Virtually all the experts recommend an emphasis on long-term rewards for long-term success.

Pay packages "will be more goal-oriented than purely market-oriented," said Steven E. Gross, who leads the United States employment compensation practice at Mercer Human Resource Consulting. Rather than depending on stock prices alone, rewards could include grants of cash or stock for concrete achievements over a period of years, he said. ...

Mr. Gross said he favored indexing pay to a company's earnings relative to the market. "If the stock goes down, it doesn't mean you're a loser," he said, if other stocks are falling as well. Though the notion of using relative, or indexed, returns "hasn't been real popular," Mr. Gross said, more companies are beginning to consider it seriously.

A trend is already emerging toward restricted and deferred stock grants, Mr. Poerio said. These can cut down on poaching of executives by other companies, he said, because they are worth something even if a company's share price falls. Grants might be made on condition that certain goals are met or only after an executive has stayed several years; executives might also be barred from selling stock for long periods.

"You get rich if the company performs well long term," Mr. Poerio said. "That really better aligns the executive's interest with stockholders."

Experts offered some suggestions for deciding how and when to grant stock.

"What a chief executive really needs is a short-, medium- and long-term plan that's tied into compensation options," Mr. St. Amour said. "They need to have milestones for that. You can actually build in the safeguards that will prevent someone from doing something in the short term that will give a negative impact in the medium or long term."

Mr. St. Amour suggested that companies invest part of their executives' short-term compensation in an "internal banking system" from which it could be withdrawn at later dates, based on continued success. He also recommended giving a bonus at the end of a longer period, like 5 or 10 years, for consistency in meeting milestones.

Milestones should not be based solely on profits and revenue, he said. "To use and measure against them alone is to disregard the fundamental things that keep an organization strong," he said. Initiating projects for growth and building relationships with clients should also be rewarded.

5. Improve company awareness of potential shifts in the value chain.

- ◆ It helps regions identify clusters on which to focus and helps companies be aware of shifts.

The Right Place's "Manufacturers Council Position Paper" (Right Place, 2002, p. 20) explains that it's important for regions focusing on specific clusters to pay attention to the dynamics of, and shifts in, the value chain as this helps point to the kinds of companies on which a region should focus.

Also, shifts in the value chain have killed many once-prosperous companies. It's in government's interest to protect its tax base by supporting active programs to make cluster companies aware of potential shifts of profits in the value chain. Government can help clusters develop early warning systems of such shifts.

Companies can get caught up in monitoring quarter-to-quarter results and become wedded to ways of doing business that have been responsible for success in the past (see quote in text box). Being too attached to a formula for success causes them to find it difficult to be aware of shifts in the value chain or foresee the magnitude of their impact.⁸⁴

Government can take an independent, outside perspective and play a vital role in providing foresight, a role many companies do not, or cannot, take on themselves.

- ◆ Profits can shift in the value chain in different directions for different products.

As the Right Place paper notes, for some products shifts in profit are **downstream** in the value chain:

Each value chain has its own set of "profit pools" or areas where companies can make money (i.e. the difference between value added and costs). Often the profits made at different levels of the value chain are radically different. For instance, the average profit margin in automobile manufacturing is around 5 percent,

Most leading businesses owe their prosperity to a fresh competitive formula As the formula succeeds customers multiply All this positive feedback reinforces managers' confidence that they have found the one best way, and it emboldens them to focus their energies on refining and extending their winning system ...

Active inertia is an organization's tendency to follow established patterns of behavior — even in response to dramatic environmental shifts. Stuck in the modes of thinking and working that brought success in the past, market leaders simply accelerate all their tried-and-true activities. In trying to dig themselves out of a hole, they just deepen it.

Donald N. Sull, "Why Good Companies Go Bad," *Harvard Business Review*, Jul-Aug 1999

⁸⁴ See the *CI* papers [Creating Reality](#) and [Creating Reality Consciously](#) for a systems explanation of this dynamic.

whereas the profit margin in automotive leasing often exceeds 20 percent. And the location of “profit pools” will shift between parts of the value chain over time.

Typically, value flows ‘downhill’ or in the direction of the end customer. This means that as a sector matures and consolidates, the profitability of the supply sector can expect to diminish. This trend is manifesting itself in many different parts of the manufacturing economy today.

However, there is a different trend that’s important for regions with a high technology industry concentration. In the presence of disruptive technologies, the value chain dynamic is such that profit flows **up-stream**, not downstream. The *HBR* article on “Skate to Where the Money Will Be” (Christensen, Raynor, and Verlinden, 2001) explains this dynamic:

Once a modular architecture and the requisite industry standards have been defined, integration is no longer crucial to a company’s success. It becomes a competitive disadvantage in terms of speed, flexibility and price, and the industry tends to dis-integrate as a consequence. ...

Disruptive competitors begin to move upmarket, and the power to make money shifts away from companies that design and assemble the end-use product toward the back end of the value chain to those companies that supply subsystems with internal architectures that are still technologically interdependent.

Note that this trend is not unique to high technology; Christensen gives examples for automobiles, banking, and university management education.

Appendix B contains other key excerpts from “Skate to Where the Money Will Be” that more fully explain this dynamic. I also indicate why his reasoning is valid from a systems point of view.⁸⁵

6. Stop allowing R&D investment tax credits to companies that do not retain their complementary assets (e.g., manufacturing) in the U.S., because when a nation that subsidizes an innovation does not retain the manufacturing, it does not fully profit from the innovation.

The nation does not fully profit because it cedes a large portion of the profits to the nations that do the manufacturing. Continuing such subsidies is a form of “reverse protectionism.”

The dynamic is explained in detail in “A Systems Thinking Perspective on A Manufacturing Base Restoration Initiative” (Powell, 2002a). Here is a summary of Teece’s rationale:⁸⁶

The more easily innovations can be imitated, the more an innovating firm risks ceding a significant share of the returns from innovation to customers, imitators and owners of complementary assets (e.g., manufacturing). To prevent this, the innovating firm itself must focus on protectable innovations, focus on products /services for which the necessary complementary assets are already under its control, or establish appropriate plans for contracting/leasing or integrating the necessary complementary assets. Managers must become adept in understanding their organizations and markets as dynamic systems.

For the same reasons that control of complementary assets, such as manufacturing, are important to companies, they also matter to innovating nations. In regions of weak appropriability, innovating firms without the requisite manufacturing and other specialized capabilities may fail and, similarly, innovating nations may allow competing nations to capture the lion’s share of the profits from the innovation.

For companies that do retain complementary assets in the U.S., increase “Investment in Competitiveness” tax credits with a long-term focus.⁸⁷ Tax credits for investments in, for example:

- R&D, both long-term basic R&D and current product innovation and development
- Capital equipment that increases productivity, quality, reduces cost, etc..
- Employee training and education
- Implementation of competitiveness improving practices, processes, and technologies
- Employee retention programs
- Participation in the Baldrige National Quality Award competition

⁸⁵ My presentation at the Rocky Mountain Product Development & Management Association [RM PDMA] meeting on April 16, 2003 was on “Surviving Disruptive Technologies and Thriving with Practical Systems Thinking.” A causal loop model that demonstrates the shifts Christensen describes is available on request by sending e-mail to scuba@usa.net.

⁸⁶ From Teece, 1986. “Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing, and Public Policy”

⁸⁷ Jim Leonard suggested this and wrote: “Package should be operational for at least ten years, with renewal decisions coming well before the ten year point. Not necessarily a 100% tax credit for all of the listed expenditures/investments, but something to encourage competitiveness development behavior.”

7. Do not let the dollar become overly strong relative to other currencies ...

- ◆ ... due to excessively high real interest rates (in the recent past).

High real interest rates⁸⁸ create an artificially strong dollar and put U.S. manufacturers at an extreme competitive disadvantage in foreign markets by making U.S. products more costly and less competitive.⁸⁹ Real interest rates that are greater than increases in productivity discourages investment in “bricks and mortar.”⁹⁰ This contributes to creating a rapidly-growing trade deficit (see earlier discussion) that cannot be sustained and that puts the U.S. economy in jeopardy.

The Right Place Position Paper notes this as a serious problem (Right Place, 2002, p. 38):

Foreign competition has been exacerbated by a recent period of excessively high dollar valuation, which encourages imports and discourages exports. Since 1997, the dollar rose as much as 30 percent over other major currencies, giving importers an effective 30 percent pricing “windfall.” This has resulted in a dramatic increase in the U.S. trade debt that is considered “unsustainable.” As much as \$300 billion of the \$450 billion trade deficit is attributed to the high value of the dollar. (More recently, the value of the dollar has fallen so that the rise in value is approximately 20 percent, correcting some of this disadvantage.)

A too-strong dollar pushes manufacturing out of the country and amounts to a form of “reverse protectionism,” which should be ended.

- ◆ ... due to currency manipulation and undervaluation by other countries.

The U.S. should not allow access to its markets by a country that creates an uneven playing field by undervaluing its currency and pegging that undervaluation to the dollar as China has. The U.S. should not allow access to its markets by any country that creates an uneven playing field by undervaluing its currency and pegging that undervaluation to the dollar. Addressing this is not “protectionism,” but ending a form of “reverse protectionism.”

Some argue that correcting this won’t solve the U.S. balance of trade problem. However, it is part of the problem and should be addressed with appropriate emphasis.

There are many, many references to this problem. The excerpts below from a *USA Today* article is one example:⁹¹

The weak Chinese currency has added \$100 billion to the U.S. trade deficit and cost a million U.S. manufacturing jobs over three years, says the Manufacturers Alliance/MAPI, a trade and lobbying group.

Others who have voiced concern recently: Fed Chairman Alan Greenspan, the International Monetary Fund, Treasury Secretary John Snow and Commerce Secretary Don Evans.

Snow told a Senate committee Thursday that the administration won’t “have a firm view” on the value of the renminbi until a report is finished in October.

The renminbi has effectively been pegged to the dollar since 1994. Beijing allows it to trade within a narrow band of 8.276 and 8.28 to the dollar. It has driven down the value by amassing foreign exchange reserves estimated at \$360 billion, second to Japan’s.

The cheap renminbi has forced U.S. producers to shift production to China and buy parts there or risk being priced out of the market.

The National Association of Manufacturers says currency manipulation by China, Japan, Taiwan and South Korea is the prime culprit in the loss of a record 2.6 manufacturing jobs since mid-2000.

An administration that does not “have a firm view” of this issue is significantly out of touch.

- ◆ ... and don’t be too concerned that a weaker dollar will cause inflation; a 5% fall in the dollar raises consumer prices 0.2% ... the impact is often overstated

Lester Thurow examined the impact (Thurow, 1996, pp. 148-150):

[T]he foreign exchange markets systematically trade dollars for foreign currencies at rates that grossly

⁸⁸ real interest rate = nominal interest rate - rate of inflation

⁸⁹ Jim Leonard points out, correctly, the danger of “blaming the trade deficit only on a strong dollar.” He notes, “What portion is due to US manufacturers’ lack of competitiveness in global markets?” Blaming can lead to inadequate attention to, first, increasing operational excellence to reduce costs and, second, using systems thinking for improving learning and strategic alignment and avoiding unintended consequences.

⁹⁰ Real interest rates that are higher than increases in productivity causes investment to shift from real assets to financial assets ... hence the leveraged buyouts of the 80s. Why should anyone invest in real assets when they can get a greater return in financial assets with greater liquidity and less risk?

⁹¹ “Congressmen: China’s currency policies hurt jobs in USA” By James Cox, USA TODAY, Posted 7/31/2003 11:27 PM, Updated 7/31/2003 11:29 PM, http://www.usatoday.com/money/world/2003-07-31-yuan_x.htm

undervalue the dollar if one looks at measures of purchasing power parity. Since Americans pay for their excess of imports over exports with dollars, large supplies of dollars flow into the world's financial markets that are not counterbalanced by demands for dollars, and this surplus of dollars has to push the dollar down. In the long run the dollar must continually fall until the current account deficit has been eliminated. ...

[A] falling dollar does not affect American living standards very much (a 5 percent fall in the value of the dollar raises consumer prices only 0.2 percent) While the real-trade-weighted value of the dollar fell 33 percent in the decade from 1984 to 1994, the prices of imports rose only 11 percent. Since America imports about 12 percent of its GDP, imports added only 1.2 percentage points of inflation to the 28 points of inflation (as measured by the implicit price deflator for the GDP) that occurred over this time period.

Because imports have increased, the effect is probably larger, but not so large as to merit the risks of continuing policies that allow an exponentially increasing trade deficit.

8. Government can increase support for training and education.

- ◆ Government support of training and education is needed due to their “positive externalities.”

There are positive externalities because a company that invests in training and educating employees can help other companies. They can lose them to competitors who do not train, because the competitors can pay higher wages by “free riding” on companies who do invest.⁹²

- ◆ Support for engineering technical education has been lagging.

As the Right Place Position Paper notes, there has been lagging support for engineering and a declining Technical Talent Pool (Right Place, 2002, pp. 76 - 80, 91).

- ◆ Financial support for education should come primarily from the Federal level to prevent “free riding” by states. Colorado is a prime example of a “free rider” state.

Lester Thurow describes the incentive for free-riding (Thurow, 1996, p. 294):

Capitalistic rationality always calls for free riding the system whenever that is possible at the individual, firm or national level. Let someone else pay for the costs of the collective investments that raise individual incomes, firm profits, or national output. Studies, for example, show that one quarter to one third of the benefits of American R&D spending accrue to other members of the OECD. Given this reality, why invest? Internationally, every country should let some other country pay for basic research (basic science moves around the world very fast and everyone has it long before it can be embodied in actual processes or products) and concentrate their funds on short-run development activities where one can potential get a short-run technical edge that might lead to higher national incomes.

Colorado invests less in education than many other states, ranking somewhere between 30th and 43rd in education funding, depending on the study.⁹³

Despite this, Colorado ranks 2nd in educational attainment by using its currently high quality of life⁹⁴ to attract the highly-educated from other states to maintain a highly-educated workforce.⁹⁵

A 9/04/03 *Denver Post* article, “Colo. fumbles on higher ed” makes this point.⁹⁶

Though the Centennial State boasts the nation's most educated populace, it has dropped the ball in sending its own to college as only 39 percent of high school students are university bound.

While the state is touted as the most educated in the nation because of its imported workforce, the truth is ugly: Colorado is lousy at sending its own children to college. ... Colorado ranks 30th in sending its own to college. Suddenly, the luster of being dubbed “most educated” begins to dull. ...

It's helpful that Colorado has risen from dead last nationally in sending its poorest students to college to No.

⁹² This is one of the major reasons why we have and need government-supported public education, instead of privatized education. Another is to promote equal opportunity and oppose the dynamics brought on by the “Success to the Successful” archetype.

⁹³ ● Sorting individual state data on Per Pupil Expenditure at the National Association of State Boards of Education shows Colorado is ranked 30th for 1998-99. http://nasbe.org/Educational_Issues/State_Stat.htm ● In the school year ending in 1999 Colorado ranked 32nd in education funding according to the National Center for Education Statistics, Institute of Education Sciences, U.S. Dept. of Education, <http://nces.ed.gov/pubs2002/digest2001/tables/dt168.as> ● According to Stateline.org, based on Per-Pupil Spending in Elementary and Secondary Schools Adjusted for Regional Differences, Colorado ranked 43rd in 2001, http://www.stateline.org/header_facts.do?headerId=52.

⁹⁴ Quality of life that continues to be negatively impacted by growing infrastructure backlogs and sprawl due to taxes that don't cover the long-term costs of growth (see the next section on tax competition).

⁹⁵ The 2002 State New Economy Index shows a “weighted measure of the educational attainment (advanced degrees, bachelor's degrees, associate's degrees, or some college coursework) of the workforce.” In 2000 Colorado ranked 2nd with a weighted score of 59.6 (Maryland ranked 1st with a weighted score of 60.9). The site notes that the more highly-educated are more mobile and that “... states like Colorado, Hawaii, and Washington that have attracted large numbers of people from other states generally have a more-educated workforce.” http://www.neweconomyindex.org/states/2002/01_knowledge_04.html

⁹⁶ *Denver Post*, <http://www.denverpost.com/Stories/0,1413,36-53-1609345,00.html>

45,⁹⁷ says scholar Mortenson, who publishes the trade newsletter, Postsecondary Education Opportunity. ...

Mortenson points to declining state appropriations to higher education and the unwillingness of Colorado's educated newcomers to fund it.

"There is a influx of college educated people from elsewhere, and there is a lack of funding for state higher education because those people tend to be more conservative, and they don't want to pay taxes while enjoying the benefits of the state," Mortenson says.

Colorado ranked 42nd in state appropriations in 2003 prior to mid-year budget cuts. In 1971, it was No. 5 in college funding. Before that, it floated between 10 and 15, Mortenson says.

"Far more than any state, Colorado has turned away from funding higher education," Mortenson says. "You clearly have a problem."

Colorado takes advantages of positive externalities contributed by other states that spend more on education and its behavior is a prime example of why education funding should primarily be from the federal level.

This is a funding issue, not a control issue; that funds should come from the federal government should not be taken to mean that the Federal government would micromanage school districts.

9. Do not engage in "tax competition," despite its allure.

- ♦ Cutting taxes may be irresistible in the face of countries that engage in "tax wars," but beware of the downside: enormous and growing infrastructure backlogs."

Cutting taxes, that is, engaging in tax competition with other countries and among regions in the U.S., to attract companies is the standard recommendation of those who wish to promote economic growth. Indeed, tax competition is lauded by the CATO Institute (Edwards and de Rugy, 2002),⁹⁸ which sees this as a desirable way to limit government.

Tax competition does attract companies and it does limit government, but the consequences are serious. The result is taxes that are insufficient to cover the long-term costs of roads and schools. This leads to infrastructure backlogs and calls for even more growth "to increase the tax base" and pay for infrastructure. Unfortunately, while there is a short-term tax benefit from growth, taxes remain insufficient to cover the long-term costs of growth; and the cycle continues.

In January of 1996 the infrastructure backlog in Colorado Springs was estimated at \$308M;⁹⁹ in early 1997 it was \$468M.¹⁰⁰ In Nov. 2000 Colorado Springs was facing a \$1B infrastructure backlog in the next 10 - 20

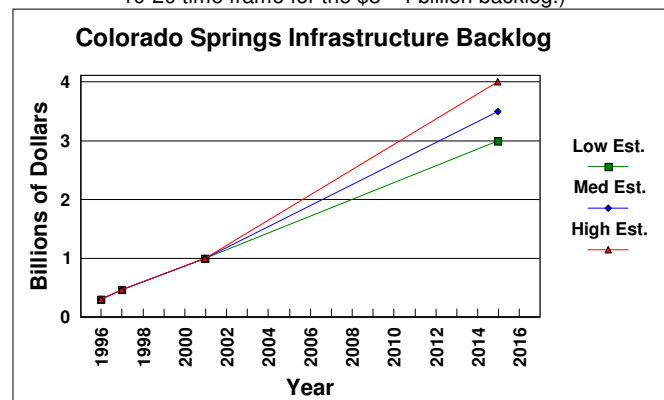
years and, according to Dave Zelenok, Group Support Manager Public Works, "if things keep going the way they are, we'll be facing a \$3 - 4 billion backlog."¹⁰¹ The trend is plotted in Figure 9.

In fact, infrastructure backlogs are a national problem. The American Society of Civil Engineers (ASCE) released a "report card" on the nation's infrastructure problems on 3/08/01 which stated:¹⁰²

To remedy America's current and looming problem, ASCE estimates a needed \$1.3 trillion investment over the next five years.

The ASCE updated this report on 9/04/03 with a current estimate of \$1.6 trillion.¹⁰³ An increase of from 1.3 to 1.6 in 2.5 years is ~9.25% per year, many times the rate of inflation.

Figure 9. The growing infrastructure backlog in Colorado Springs. (15 years is used as the midpoint in the 10-20 time frame for the \$3 - 4 billion backlog.)



⁹⁷ Wow! Quoting one of my favorite public figures, "That's something to be proud of."

⁹⁸ Edwards, Chris and de Rugy, Veronique, "International Tax Competition — A 21st - Century Restraint on Government," 4/12/02, <http://www.cato.org/pubs/pas/pa431.pdf>

⁹⁹ "1999-2000 Capital improvement needs versus estimated funds," City of Colorado Springs, Capital Improvements Division, January 1996. Included in The Springs Community Action Plan, City Government Task Force, Strategic Planning Workbook, January 1996.

¹⁰⁰ Early 1997 backlog estimate: \$468M. Councilman Bill Guman, "Prefer to Believe 'The Glass is Half Full'", *Woodmen Edition*, 2/14/97

¹⁰¹ Woodmen Edition, 7/28/00

¹⁰² ASCE Report Card; News Release: <http://www.asce.org/reportcard/index.cfm?reaction=news&page=2>

¹⁰³ For the report go to <http://www.asce.org/reportcard/>.

Infrastructure backlogs impose enormous costs. Examples are the time people spend in traffic¹⁰⁴ and widespread economic distress due to the unreliability of electric power as in the blackout of 8/14/03.¹⁰⁵

- ◆ States engaging in tax competition by cutting taxes on corporations to attract them must be prepared to explain to other taxpayers that their taxes must be raised to pay for infrastructure.

States raise sales and property taxes to finance improvements and reduce the infrastructure backlogs. In reaction, in some states (e.g., CO) citizens have passed constitutional amendments (e.g., Gallagher and TABOR) that limit taxes on homeowners and the public. Because infrastructure costs continue to rise there are moves to modify and repeal tax limitation statutes.

As these backlogs are already enormous, states that engage in tax competition must be prepared to explain that they are cutting taxes on businesses to attract jobs and shifting the burden of taxation to the public at large.

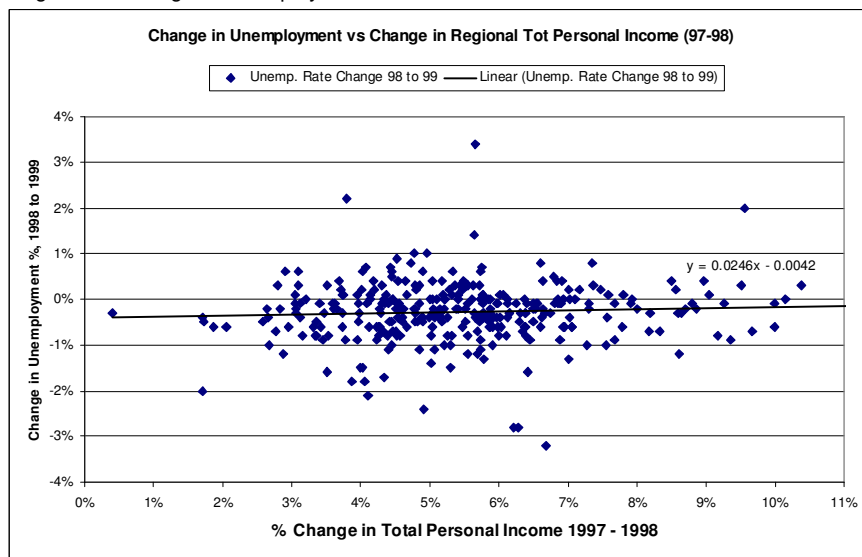
- ◆ Tax competition within the U.S. does not “create jobs,” it only redistributes them.

Beyond this very real infrastructure problem, tax competition does not “create jobs.” It does shift jobs among regions, creating higher growth in some regions and lower growth in others, but without producing favorable changes in unemployment.¹⁰⁶ Figure 10 shows that higher growth regions do not result in changes in unemployment (people who are out of work in one region move to the higher-growth regions).

The reason is that U.S. government policy only allows so many jobs to be created in the United States. The Federal Reserve Board keys monetary policy and interest rates to a NAIRU (Non-Accelerating Inflation Rate of Unemployment ... nominally on the order of 5 or 6%). Because of this:¹⁰⁷

Employment depends on the overall macro-economic environment ... [it] depends in the short run on aggregate demand ... [it] depends in the long run on the NAIRU.

Figure 10. Change in Unemployment vs. Economic Growth for MSAs



If the Federal Reserve believes too many jobs are created, or believes unemployment too low (below its NAIRU target), it raises interest rates to slow the economy and reduce demand. Lower demand is achieved by having less investment and fewer people working. The Federal Reserve pursues this policy in the belief that it must do so to avoid an inflationary wage-price spiral.

Therefore cutting taxes in one region merely produces a zero-sum game competition between regions that, in the end, hurts all regions. We need cooperation between regions, not tax competition. As gas stations have learned, price wars do considerable economic damage ... and often nobody wins. The federal government should declare a tax competition moratorium: a “tax war” cease fire.

¹⁰⁴Americans spend 8 billion hours/year stuck in traffic and lost productivity due to traffic congestion is \$43 - \$168B/year (Sterman, 2000).

¹⁰⁵Midwest Utilities Were Warned About Pushing Limits of System, by Andrew C. Revkin & Matthew L. Wald, NY Times, 8/18/03, <http://www.nytimes.com/2003/08/18/national/18GRID.html>

¹⁰⁶For more on this phenomenon, see *The Tangle of Growth* (Powell, 2001).

¹⁰⁷While there is much to disagree with in the course, Economics 1420, American Economic Policy, it is correct about the second sentence in this quote: “Trade is not about creating jobs. In trade debates, you hear supporters of free trade claim it will increase aggregate employment and opponents saying it will cost jobs. BOTH ARE WRONG. Employment depends on the overall macroeconomic environment ... depends in the short run on aggregate demand ... depends in the long run on the NAIRU.” The reason this doesn’t hold for trade is the “trade” now is in the movement of the factors of production, not just trade in the products produced. See the earlier section on the “theory of comparative advantage.” Reference: <http://www.courses.fas.harvard.edu/~ec1420/>, and the handout on “Trade Policy and Globalization,” http://www.courses.fas.harvard.edu/~ec1420/lectures/Trade_Policy1.handout.pdf.

- ◆ “Tax wars” with other countries does not help them in the long run; it only allows countries to lower taxes to the point that they mortgage their long-term future for short-term gain.

Countries that want access to U.S. markets will be willing to trade on a level playing field. Allowing “trade” with, and “transfer of the factors of production” to, countries that cut taxes below the level required to meet long-term infrastructure needs is not doing them a favor.

Addressing this is not “protectionism,” but ending a form of “reverse protectionism.”

10. Do not allow corporations to engage in flawed transfer pricing schemes to avoid U.S. taxes that distort accounting of profits and losses.

The U.S. can require accounting standards that disallow obviously fraudulent transfer pricing schemes whereby corporations move profits to foreign subsidiaries to take advantage of the lower taxes in foreign countries (resulting from tax wars). Allowing such transfer pricing schemes is a form of “reverse protectionism.”¹⁰⁸

11. Exclude corporations that move their headquarters to foreign countries from government contracting.

Corporations that benefit from U.S. infrastructure, legal systems, and military protection must be required to contribute their fair share to maintaining them. Not doing so is a form of “reverse protectionism” that drives corporations out of the country.

12. Domestic tax policy should be geared to increasing demand, not promoting investment, because of where the economy is in the long wave cycle.

In the trough of the long wave, there’s overcapacity and supply that exceeds demand for almost everything (steel, autos, semiconductors, laid optical fiber, etc. ...). Current administration policies designed to increase investment and further increase capacity will not work. They lead to a prolongation of economic stagnation in the trough of the long wave.¹⁰⁹ No matter how much taxes are cut for corporations and the wealthy, there will be no investment without demand.

The needed policy is to return taxes on corporations and higher income individuals to previous levels and cut income and payroll taxes (at least temporarily) for lower income individuals to increase demand. Do this and everyone will do better ... as they did in the 90s.

13. Measure and publicize “national productivity” based on *all available U.S. worker hours*, in addition to the highly-publicized hourly productivity of employed workers.

We read exultant stories in the press of soaring productivity:¹¹⁰

US productivity soars By Jeannine Aversa in Washington

AMERICA’S businesses pumped out more with fewer employees last quarter in a big boost for productivity, and new claims for unemployment benefits are rising, underscoring the strains facing workers even as the economy gains momentum.

Productivity – the amount an employee produces for each hour of work – soared at an annual rate of 6.8 per cent in the April-to-June quarter, marking the largest increase since the first quarter of 2002, according to revised figures released today by the Labour Department. That was even stronger than the Government’s initial estimate of a 5.7 per cent growth rate.

The productivity gain comes as 170,000 jobs were shed during the second quarter and businesses squeezed more efficiency out of the workers they kept.

In another report from the department, new applications for jobless benefits rose last week by a seasonally adjusted 15,000 to 413,000, the highest point since the middle of July.

“While companies may be getting a bit more optimistic on other fronts, they have not yet taken that last step to add to their staffs,” said Carl Tannenbaum, chief economist at LaSalle Bank. “Hiring people back full time is a significant commitment, so demand has to be absolutely solid for them to think about bringing people back.

¹⁰⁸These schemes may significantly alter the understanding of our trade deficit. Because 40 - 50% of foreign “trade” is intracompany transfers, significantly undervaluing transfers abroad and significantly overvaluing transfers to the U.S. could considerably distort the calculations. Perhaps the trade deficit is not as negative as it appears? It should be said, however, that even if the cumulative trade deficit is only half the official numbers, with exponential increases, it’s still going out of sight.

¹⁰⁹ In which there will be business cycles and a “bumping along the bottom.”

¹¹⁰ “U.S. productivity soars 9.4 percent” 12/3/03 http://finance.news.com.au/common/story_page/0,4057,7173584%255E462,00.html or <http://www.whas11.com/sharedcontent/business/topstories/120303ccbizproductivity.671f2dc9.html> .

Looking at the official productivity statistic, one wouldn't think there's any problem at all.

A publicized statistic taking into account the output of the nation per worker for all worker hours available would be a more realistic measure of U.S. national productivity. This measure would be falling and would likely generate significantly more national concern about the state of the economy and workforce employment than the misleading official productivity statistic or the significantly understated "official unemployment" statistic.

14. Include environmental standards in trade pacts.¹¹¹

Countries that want access to U.S. markets will be willing to abide by environmental standards and trade on a level playing field. Not including environmental standards in trade pacts is a form of “reverse protectionism.”

- ♦ Trading with countries that do not abide by comparable environmental standards creates an uneven playing field and does not help them in the long run; it only allows them to mortgage their long-term future for short-term gain.

A damaged environment creates a long-term burden on the health of the population and often destroys the means by which many make a living.

- ♦ It is incorrect that, as incomes increase, citizens of other countries will value their environment more and increase protections so as to lower pollution in the future.

Those familiar with this issue will recognize that this conclusion is controversial. Below are the arguments pro and con.

The foundation of the idea that environmental standards should not be included in trade pacts is that environment is a commodity to be valued by the market as is any other commodity (Thompson and Strohm, 1996, p. 375).

The theory of comparative advantage is a positive theory about the patterns of trade: A country will tend to export products that use intensively factors of production with which it is relatively well endowed, and import those products that use intensively its scarce factors. The mechanism that translates relative factor scarcity into trade patterns is of course the pricing mechanism, and as Siebert (1985) explains, the principle applies equally to the pricing of the environment.

Assume that the home country introduces an emission tax and thereby impairs its comparative price advantage for the pollution-intensive commodity. Its exports will fall, and the production of the pollution-intensive commodity will be reduced. A reallocation of resources takes place.... Since the comparative price advantage of the home country deteriorates for the pollution-intensive commodity, the comparative price advantage of the foreign country rises. In the foreign country, a reallocation of its resources occurs in favor of the pollution-intensive commodity so that emissions increase and environmental quality abroad worsens. In short, the environmental policy of the home country negatively affects the environmental quality in the foreign country through specialization and by trade. (Siebert, 1985, pp. 155-156)

Under a set of additional assumptions, which primarily ensure that relative prices accurately reflect relative scarcity and that domestic income distribution policies are set correctly, specialization through trade raises welfare relative to autarky.

Although the inclusion of an “environmental factor” in the theory of comparative advantage has a substantial intellectual history, its meaning is not without controversy. Most researchers have defined a country that is relatively well endowed with “environment” as one that has a relatively large environmental assimilative capacity, by which it is usually meant that the country has an above-average ability to tolerate, dilute, absorb, or ignore, pollution. In a world in which governments adopt domestic environmental policies that accurately reflect domestic valuations of environmental quality, the implicit rewards earned from polluting activities will vary inversely with the costs of pollution. In the presence of trade, countries that attach a high social cost to environmental degradation will tend to specialize in the production of goods and services that do not pollute intensively; countries that attach low social costs to degradation will tend to specialize in pollution-intensive commodities.

The Cato Institute’s Daniel T. Griswold argues against environmental and labor standards, calling them sanctions:¹¹²

The greatest threat to the passage of TPA [Trade Promotion Authority] is the demand by some members of Congress that it require the use of trade sanctions to “enforce” higher labor and environmental standards in poor countries.

The case for sanctions rests on the myth of a “race to the bottom.” Without a hammer held over their heads, poor countries will supposedly exploit the “unfair advantage” of low standards to grab investment and export markets from rich countries. But low standards appear to be more of a handicap than an advantage. Of the \$1.1 trillion in global foreign direct investment flows in 2000, only 17 percent went to less developed

¹¹¹The argument against including labor and environmental standard protections is that they are “protectionist.” I contend not doing so is “reverse-protectionist.” Those who see labor and environmental standard protections as “protectionist” usually see strong “intellectual property” protections as appropriate for inclusion in trade agreements because they protect capital instead of labor. So it’s not that opponents of labor and environmental standards don’t want restrictions on trade, they just want the *right kind* of restrictions.

¹¹²Daniel T. Griswold, “Labor and Environment Sanctions Would Poison Trade Talks,” 9/28/01, <http://www.cato.org/dailys/09-28-01.html>. Note: Daniel T. Griswold is associate director the Cato Institute’s Center for Trade Policy studies.

countries, down from about 40 percent in the mid-1990s. American manufacturing companies directly invest far more in the high-standard economies of the European Union than in all of the developing world. In fact, nations with the highest environmental standards, as measured by the World Economic Forum's "2001 Environmental Sustainability Index," consistently attract the most FDI per capita.

Around the world, a fundamental dynamic is at work: Nations open to trade and foreign investment tend to grow faster and achieve higher incomes than less open nations, leading to higher labor and environmental standards. Through this powerful channel, globalization encourages a race, not to the bottom, but toward the top.

For less developed countries, engagement in the global economy lifts real wages and labor standards. According to a study by the U.S. International Trade Commission, wages, salaries, and labor standards are higher in export-oriented sectors than in those that produce non-traded goods. And jobs in foreign-owned affiliates generally pay significantly higher wages than do those in domestically owned firms. And rising incomes spurred by trade allow more poor families to send their kids to school, reducing child labor.

Higher incomes tend to lift environmental standards as well. A study of cross-country data by the Cato Institute found a strong correlation between high incomes and high environmental standards. In fact, higher incomes appear to be a prerequisite for higher standards. Cross-country data reveal a "green ceiling" under which nations must first raise their per capita income level before achieving higher environmental standards. In other words, while some countries have managed to achieve high per capita incomes without high environmental standards, no country has achieved high standards without high incomes.

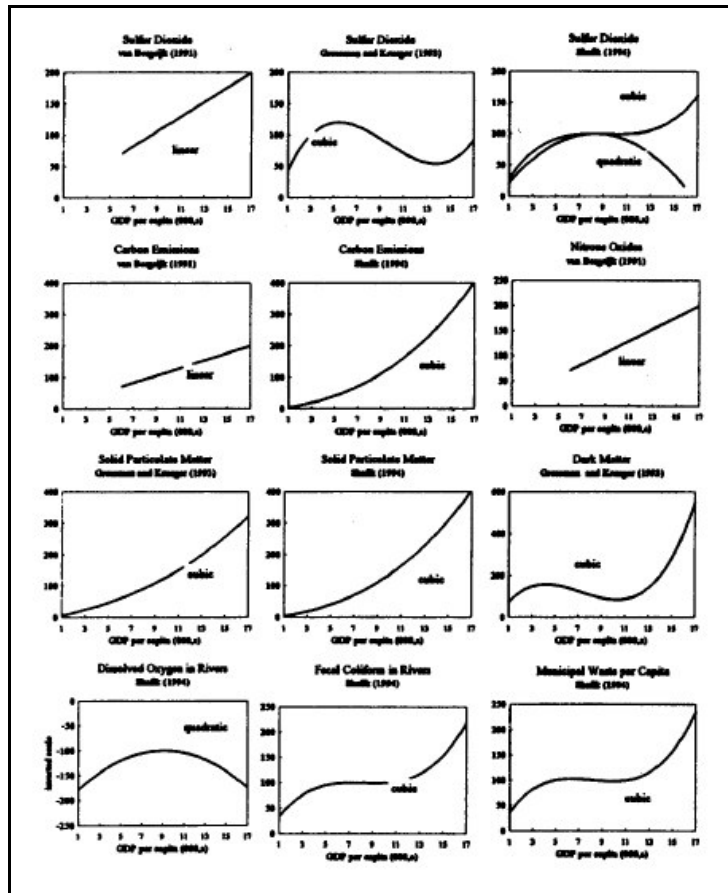
Peter Thompson and Laura A. Strohm, in a paper on "Trade and Environmental Quality: A Review of the Evidence," note several problems with this argument (Thompson and Strohm, 1996).

The first is that the "higher income, lower pollution" evidence is far from strong and requires selective use of the data as shown in Figure 11.¹¹³ Of the 12 relationships between pollution and GDP shown, only two, SO₂ (top right in Figure 11) and "dissolved oxygen" (bottom left in Figure 11) increase initially and then decline to form an inverted-U shaped relationship.¹¹⁴

Unfortunately, some economists — most prominently in GATT (1992) — have tended to draw attention only to the results that point most strongly to the existence of inverted-U shaped relationships. GATT's interpretation of the evidence is correct only with respect to SO₂ and dark matter pollution, however, and even in those cases it is misleading: Of the 138 countries contained in the data for GDP used in the Grossman and Krueger (1993) study, only 41 have incomes per capita exceeding the U.S. \$5,000 threshold (Summers & Heston, 1991, pp. 350-354). If trade liberalization were to increase incomes in every country, in more than 70% of the countries one must predict a deterioration of air quality.

We are not the only ones to object to the GATT's use of the Grossman and Krueger (1993) evidence. For example, Arrow, Bolin, Costanza, and Dasgupta observe that while (the results) do indicate that economic growth may be associated with improvements in some environmental indicators, they

Figure 11. Statistical estimates of the relationship between income (GDP) and pollution from Thompson and Strohm, 1996.



¹¹³These graphs in the figure are difficult to read in the paper as downloaded from the web. The x-axes are "GDP per capita" and the y-axes are concentrations of various pollutants.

¹¹⁴And even then a least square fit to a quadratic equation is necessary to show such a relationship. If the fit is to a cubic equation as in several charts in the figure, then there is a slight decline at a GDP per capita of approximately \$6000 and pollution increases thereafter. The relationships for other sources of pollution show this cubic behavior, linear or even exponential increases as GDP per capita increases.

imply neither that economic growth is sufficient to induce environmental improvement in general, nor that the environmental effects of growth may be ignored. (1995, p. 520) ...

There is, in essence, no way to reach firm conclusions about the relative importance of scale and income effects on the basis of international evidence. Thus, our reading of the evidence is that one cannot make much of a claim for a positive link between environmental quality and income growth, in stark contrast to the optimistic claims that have been made: No matter how one looks at [the graphs of statistical estimates of the relationship between income and pollution] ..., one cannot help but notice that there are a lot of positive slopes there.

The second problem is that even if the inverted-U relationship were valid, correlation is not causality. And, as Thompson and Strohm, (1996) explain:

The simple, and standard, story is that the relationship is a result of income effects, which presumably induce more stringent environmental regulations and consequent changes in the techniques and patterns of production. We are skeptical about that. A more plausible explanation seems to be that the development process of the last 30 years or so has produced a natural evolution of comparative advantage that has induced changing international patterns of production that have nothing to do with preferences for environmental quality; moreover, it is simply a historical accident that the richest countries have developed a comparative advantage in technology — and skill-intensive industries that are, by good fortune, less polluting than labor-intensive heavy industries.

The difference of interpretation is critical. If the cause of the inverted U-shaped relationship is an income effect raising demand for environmental quality, then we can predict that as countries increase income, their pollution intensity will follow the same U-shape obtained from cross-sectional data. In other words, the policy implication is that the best way to protect environmental quality would be to ensure that every country's per capita income rises above \$5,000 per year, perhaps through trade-induced growth. But if our interpretation is correct, a very different environmental future emerges. By definition, some countries will always have comparative advantage in labor-intensive dirty industries, and so some countries will always be pollution intensive no matter how rich the world gets. In this case, the inverted U-shaped relationship between GDP and pollution is not static; rather, the curve shifts to the right as world incomes rise, and countries will remain at the same relative position on the curve, locked into a global structure of unequal pollution distribution. There is, unfortunately, no evidence that allows us to distinguish between these two interpretations.

And finally, though Griswold argues that in "... developed countries, engagement in the global economy lifts real wages and labor standards," as wages increase, jobs are moving from Mexico to China where wages are even less.¹¹⁵

All along the Mexican border with the United States, once-busy factories are closing. Since the end of 2000, tearful farewell parties have been held for 250,000 factory workers in Mexico.

Some of the same jobs that left North Carolina textile plants and Ohio auto-parts assembly lines for Mexico in the 1980s are now moving to Asia. The reason is the same: cheaper labor.

The loss of jobs here in part reflects the slowdown in the U.S. economy.

But many of the plant closings are just the globalized economy at work. Factories came to take advantage of low wages; now that success has driven wages up, they are moving on. Mexico is left with a bittersweet legacy: higher wages, but fewer jobs.

More than 500 foreign-owned assembly-line factories in Mexico, called maquiladoras, have closed in the past two years, in part because wages have doubled in the past 10 years and are no longer considered low in the world economy. An entry-level factory worker in Tijuana earns \$1.50 to \$2 an hour, compared with 25 cents an hour in parts of China.

This is a classic "race to the bottom" and belies the Cato Institute's characterization that the "race to the bottom" is a "myth." And, as the Right Place Position Paper (Right Place, 2002, p. 40) describes:¹¹⁶

Many companies that go to China with the intent of selling into the Chinese market discover that there is very little demand due to the low income structure, and instead shift to exporting from China to other markets.

If and when living standards are raised, they are not raised enough.

¹¹⁵"Cheaper labor in Asia drains jobs from Mexico" Mary Jordan, *The Washington Post*, June 21, 2002, <http://www.denverpost.com/Stories/0,1413,36%257E23827%257E687294,00.html> .

¹¹⁶This is also noted earlier in the section "Inform companies that creating markets in China is hazardous."

- ◆ In countries without constitutional democracies (especially in dictatorships) and without the technical competence and financial means to perform sound science, citizens cannot properly value their environment; the market doesn't set prices for the environment, governments do.

The lack of democracy and effective political institutions affects the ability of nations to make sound economic decisions (Thompson and Strohm, 1996):

However, if one does include the environment in the theory of comparative advantage, an important caveat is in order. This caveat is, of course, that the market does not set prices for the environment and that is, therefore, a task for government. It is quite possible that the government will price the environment incorrectly (by which we mean that it fails to require the full internalization of the costs of environmentally harmful practices¹¹⁷). If that should happen, then it is still true that countries will tend to export the goods that use intensively factors of production that are relatively cheaper. But it is no longer true that trade patterns reflect relative scarcity, nor that trade is unambiguously welfare increasing.

Also, developing countries lacking the capability to perform sound science cannot properly evaluate impacts on health and the environment (Yoshino, et al., 2002):

It is sometimes argued that lower environmental standards in developing countries simply reflect local conditions and priorities: economic concerns may be more critical than environmental quality or public health. Ideally, countries choose standards that reflect public demand for safety and environmental protection based on a sound understanding of impacts on health and the environment. However, institutional challenges can make this ideal unrealistic. Without strong democratic institutions and access to sound science, governments may not have the incentive or the ability to set proper standards.

Weak governance generally leads to a level of protection lower than the nominal legal standard. Although corruption can be one cause, more banal governance failures, such as lack of testing facilities and inability to monitor and control imports may be even more significant.

Trade with countries with totalitarian regimes shifts the benefits of economic activity to the few and the costs to the many. It is privatization of the profits derived from environmental damage and socialism of the costs of environmental damage.

15. Include labor standards in trade pacts.

Countries that want access to U.S. markets will be willing to abide by labor standards and trade on a level playing field. Not including labor standards in trade pacts is a form of “reverse protectionism.”

- ◆ Trading with countries that do not abide by comparable labor standards creates an uneven playing field and does not help them in the long run; it only allows them to mortgage their long-term future for short-term gain.

The cost of health problems and death are passed on to individuals and the population at large, rather than being internalized by those profiting from the economic activity. It destroys the ability of many to make a living.

- ◆ Requiring labor and environmental standards for trading partners helps them develop a more productive and loyal workforce.

“The principle is the same as having safety and environmental regulations on companies: safe, happy, well-treated employees are more productive and more loyal — able and willing to think like enlightened owners.”¹¹⁸

- ◆ In countries without constitutional democracies (especially in dictatorships) and without the technical competence and financial means to perform sound science, citizens cannot properly evaluate the effects of detrimental labor practices.

The argument is the same as above relative to environmental standards. Trade with countries with totalitarian regimes shifts the benefits to few and the cost to the many ... it is privatization for the profits and socialism for the costs. The use prison labor is a particularly egregious practice that should offend those who believe in the virtues of democracy.

16. Include intellectual property protection standards in trade pacts.

Intellectual property protections for patents, copyrights and trade marks protect private capital built up over centuries. They maintain incentives for investment in discovering new knowledge and products. With inadequate trade protections for intellectual property, which must be strictly monitored and enforced, our

¹¹⁷The U.S. itself is far from perfect in fully internalizing the costs of environmentally harmful practices. Many consider it their God-given right to pollute.

¹¹⁸Thanks to Jim Leonard for this observation.

private intellectual capital is being undermined and will continue to seriously erode.

17. Recognize the parallels between protecting intellectual property and protecting labor and the environment: intellectual property protections protect private capital; labor/environmental protections protect social capital.

Just as intellectual property protections protect private capital, labor and environmental standards protect social capital, or quality of life, built up over centuries. They protect our ability to further increase social capital. With inadequate trade protections for labor and environmental standards, which must be strictly monitored and enforced, our (labor and environmental) social capital is now being undermined and will continue to seriously erode.

Note that “free trade” proponents don’t have a problem working toward enforcing intellectual protection restrictions because they protect private capital, rather than social capital.

It’s likely that labor and environmental standards may not be as bad as they appear because they will produce a more productive workforce in the long run. Also, just as Ford paid workers more so they could afford to buy cars, increasing worker pay in other countries would actually allow them to buy our products.

18. There are so many factors affecting trade that achieving a “level playing field” is extremely difficult. Therefore, focus on outcomes by promoting “even trade,” not “free trade.”

Suggestions above indicate that the goal should be to create “level playing fields” that bring trade into balance. However, it’s apparent from the section on “The U.S. economy in trouble: a perfect storm” that there are so many complex factors affecting trade that the “formula” for stopping “reverse protectionism,” that is, creating a “level playing field,” is probably so complex that it’s not just difficult, but impossible.

So perhaps attempting to stop “reverse protectionism” is a start, but ultimately national survival in economic war must depend on outcomes ... achieving balance. Individuals try to make “even trades” of value. Governments should strive for that as well.

Warren Buffett, also concerned with the long-term problems caused by international trade that’s “out of balance,” has proposed an Import Certificates mechanism to create balanced trade to deal with what he describes as “a shifting maze of punitive tariffs, export subsidies, quotas, dollar-locked currencies, and the like.”¹¹⁹

19. Enforce intellectual property and labor/environmental protections by a certification process

The enforcement of these concerns would need to be by a certification process (ISO-like). Because our markets are so large, countries that want access would comply. And European countries tend to be more progressive than the U.S. and would likely support such moves. U.S. and European efforts would have positive externalities in that other countries that did not expend the effort would also benefit.

20. Identify those to whom companies will listen and trust, those who have the needed credibility to convey these messages.¹²⁰

Examples are messages on the need to improve operation excellence, on shifts in the value chain, on how keeping manufacturing in the U.S. is a national security issue, etc..

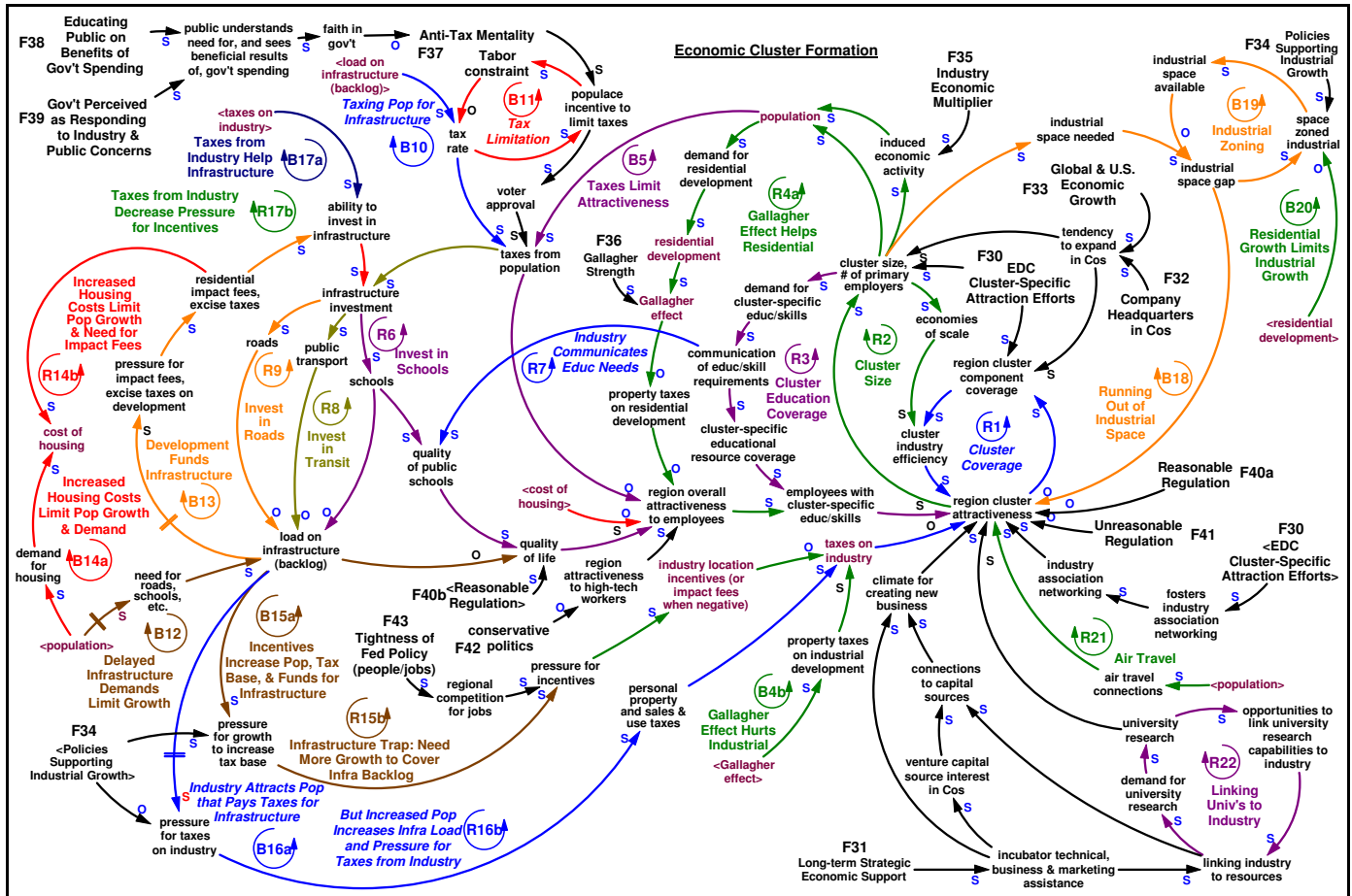
¹¹⁹ Warren E. Buffett, “America’s Growing Trade Deficit Is Selling the Nation Out From Under Us. Here’s a Way to Fix the Problem — And We Need to Do It Now.” *FORTUNE*, 11/10/03. http://www.fortune.com/fortune/investing/articles/0_15114_525644_00.html.

¹²⁰ This need came from comments from Jim Leonard. He observed: “Not sure any government, State or federal, has the credibility to do this. First, CEOs and other upper management must be motivated/inspired to think and act strategically instead of short-term. This probably has to start with the most credible and knowledgeable Wall Street analysts and firms. Maybe credible business people like Warren Buffett, Andy Grove, Peter Drucker, Jim Collins could get CEOs’ attention, but it hasn’t happened yet.”

VIII. Appendix A: Fostering Economic Clusters

Figure 12 shows the Complex Electronics Cluster Causal Loop Diagram showing driving forces as well as feedback loops. Below is a description of the causal feedback loops (Rs & Bs) and driving forces (Fs) identified from interviews and the literature.

Figure 12. The Complex Electronics Cluster Causal Loop Diagram



- R1: Cluster Coverage** - The more attractive and competitive the region, the more attractive the cluster.
- R2: Cluster Size** - Greater cluster attractiveness, the more likely other companies in the cluster will locate and/or expand in the region and the greater the cluster economies of scale.
- R3: Cluster Education Coverage** - The greater the cluster size, the more cluster-specific educational resources can be developed to increase the number of employees with cluster-specific education to increase region attractiveness.
- R4a: Gallagher Effect Helps Residential** - The greater the cluster size, the greater the population and residential development, which increases the Gallagher effect to reduce residential property taxes and further increase cluster attractiveness.
- B4b: Gallagher Effect Hurts Industrial** - The greater the cluster size, the greater the population and residential development, which increases the Gallagher effect to increase industrial property taxes and further decrease cluster attractiveness.
- B5: Taxes Limit Attractiveness** - Increased cluster size leads to greater taxes from the population. Larger taxes decrease region attractiveness.
- B6: Invest in Schools** - Increasing taxes increases investment in schools to make the region more attractive to employees.
- R7: Industry Communicates Educ Needs to Schools** - Increasing “communication of educ/skill requirements” increases the “quality of public schools” and increases “region cluster attractiveness”.
- R8: Invest in Transit** - More investment in public transit decreases “load on infrastructure” and increases “quality of life” to increase “attractiveness to employees” and “region cluster attractiveness”.
- R9: Invest in Roads** - More investment in roads decreases “load on infrastructure” and increases “quality of life” to increase “attractiveness to employees” and “region cluster attractiveness”.
- B10: Taxing Pop for Infrastructure** - When “load on infrastructure” increases, there is pressure to raise taxes to increase “infrastructure investment.”
- B11: Tax Limitation** - When the “tax rate” increases, pressure can arise to limit taxes.
- B12: Delayed Infrastructure Demands Limit Growth** - After some delay, increased “population” leads to more “need for roads, schools, etc..” This decreases “quality of life” making the region less attractive and limiting growth.

- B13: Development Funds Infrastructure** - Increasing “load on infrastructure” increases “pressure for impact fees, excise taxes on development” to provide funds for “infrastructure investment.”
- B14a: Increased Housing Costs Limit Pop Growth & Demand** - Increased housing costs reduce “region cluster attractiveness”, population growth, and demand for housing.
- R14b: Increased Housing Costs Limit Pop Growth & Need for Impact Fees** - When the area isn’t growing, lower population reduces “load on infrastructure” and the need for impact fees.
- B15a: Incentives Increase Pop, Tax Base, & Funds for Infrastructure** - As “load on infrastructure” increases, “pressure for growth to increase tax base” develops. Regions offer incentives (lower taxes & less regulation) to attract industry which lowers “taxes on industry” and attracts more “population” that pays more taxes to “load on infrastructure”.
- R15b: Infrastructure Trap: Need More Growth to Cover Infra Backlog** - As “load on infrastructure” increases, “pressure for growth to increase tax base” develops. Regions offer incentives (lower taxes & less regulation) to attract industry which lowers “taxes on industry” and attracts more “population” and again increases the “load on infrastructure”.
- B16a: Industry Attracts Pop that Pays Taxes for Infrastructure** - As “load on infrastructure” increases, regions feel “pressure for taxes on industry”. This decreases “region cluster attractiveness” and attracts less “population” and reduces “load on infrastructure”.
- R16b: But Increased Pop Increases Infra Load and Pressure for Taxes from Industry** - As “load on infrastructure” increases, regions feel “pressure for taxes on industry”. This decreases “region cluster attractiveness”; this attracts less “population” from which there are less “taxes from population” and consequently less “infrastructure investment”, which increases “load on infrastructure” and “pressure for taxes on industry”.
- B17a: Taxes from Industry Help Infrastructure** - More “taxes on industry” increase “infrastructure investment” and decrease “pressure for taxes on industry”.
- R17b: Taxes from Industry Decrease Pressure for Incentives** - More “taxes on industry” increase “infrastructure investment” and decrease “pressure for growth to increase tax base” and “pressure for incentives”. This effectively increases “taxes on industry”.
- B18: Running Out of Industrial Space** - As “cluster size” increases, there is more “industrial space needed”, increasing the gap between “industrial space needed” and “industrial space available”.
- B19: Industrial Zoning** - Creating more “space zoned industrial” closes the gap between “industrial space needed” and “industrial space available”.
- B20: Residential Growth Limits Industrial Growth** - Primary and secondary industry growth increases population and residential development. This reduces space available for industrial development and the attractiveness of the region to companies.
- R21: Air Travel** - Increasing “population” leads to improved “air travel connections,” increasing “region cluster attractiveness” and “population.”
- R22: Linking Univ’s to Industry** - “Linking industry to resources” leads to more “university research” and “opportunities to link university research capabilities to industry.”
- F30: EDC Cluster Specific Attraction Efforts** - EDC attraction efforts to attract missing cluster components and add new companies; also “fosters industry association networking”.
- F31: Long-term Strategic Economic Support** - Provides “incubator technical, business & marketing assistance” to increase “region cluster attractiveness.”
- F32: Company Headquarters in Cos** - Companies with headquarters in Colorado Springs are more likely to expand here.
- F33: Global & U.S. Economic Growth** - Greater growth increases “tendency to expand” in Colorado Springs.
- F34: Policies Supporting Industrial Growth** - Increase “space zoned industrial” and “pressure for growth to increase tax base”; decrease “pressure for taxes on industry”.
- F35: Industry Economic Multiplier** - The greater the “industry economic multiplier”, the greater the impact of primary employers in terms of “induced economic activity”.
- F36: Gallagher Strength** - Increases “Gallagher effect” that lowers property taxes on residential development” and increases “property taxes on industrial development”.
- F37: Anti-Tax Mentality** - Increases “populace incentive to limit taxes” and the strength of the “Tabor Constraint”. Tabor limits the amount of taxes that can be collected by requiring a vote on tax increases; the “one subject” rule prevents a guaranteed simultaneous decrease in one tax as another increases.
- F38: Educating Public on Benefits of Gov’t Spending** - The more the public is educated on the benefits of government spending, the greater “voter approval” will be for taxes for infrastructure.
- F39: Gov’t Perceived as Responding to Industry & Public Concerns** - The more “government is perceived as responding to company and public concerns”, the greater “voter approval” will be for taxes for infrastructure.
- F40a: Reasonable Regulation** - Direct decreases “region cluster attractiveness” (any regulation decreases region attractiveness).
- F40b: Reasonable Regulation** - The definition in this context of “reasonable regulation” is that it has some benefit in increasing “quality of life”.
- F41: Unreasonable Regulation** - Decreases region attractiveness without an offsetting improvement of “quality of life”.
- F42: Conservative Politics** - Reduces attractiveness of the region to high tech employees.
- F43: Tightness of Fed Policy (people/jobs)** - The Federal Reserve raises interest rates when unemployment is considered to be too low based on fears that it might start a wage-price inflationary spiral.

How to Use an Economic Cluster Causal Loop Model

The problem the model addresses: How can we foster cluster formation?

The process for using the model:

- Group review of model. Modify and enhance model, as needed.
- Group evaluation to determine the ranked importance of the loops and driving forces using the process described in the *CIA* paper, **Facilitating Group Action** (use table below).
- Develop strategies and action plans. Use the “strategy matrix” approach described in the *CIA* paper, **From Causal Loops to Action**: Each individual or group involved in a loop defines the strategies and actions to be employed to foster the beneficial behavior of the feedback loop.
- Use standard project management techniques to manage the project.

Feedback Loops and Driving Forces	Votes	Feedback Loops and Driving Forces	Votes
R1: Cluster Coverage		B19: Industrial Zoning	
R2: Cluster Size		B20: Residential Growth Limits Industrial Growth	
R3: Cluster Education Coverage		R21: Air Travel	
R4a: Gallagher Effect Helps Residential		R22: Linking Univ's to Industry	
B4b: Gallagher Effect Hurts Industrial		F30: EDC Cluster Specific Attraction Efforts	
B5: Taxes Limit Attractiveness		F31: Long-term Strategic Economic Support	
B6: Invest in Schools		F32: Company Headquarters in Cos	
R7: Industry Communicates Educ Needs to Schools		F33: Global & U.S. Economic Growth	
R8: Invest in Transit		F34: Policies Supporting Industrial Growth	
R9: Invest in Roads		F35: Industry Economic Multiplier	
B10: Taxing Pop for Infrastructure		F36: Gallagher Strength	
B11: Tax Limitation		F37: Anti-Tax Mentality	
B12: Delayed Infrastructure Demands Limit Growth		F38: Educating Public on Benefits of Gov't Spending	
B13: Development Funds Infrastructure		F39: Gov't Perceived as Responding to Industry & Public Concerns	
B14a: Increased Housing Costs Limit Pop Growth & Demand		F40a: Reasonable Regulation	
R14b: Increased Housing Costs Limit Pop Growth & Need for Impact Fees		F40b: Reasonable Regulation	
B15a: Incentives Increase Pop, Tax Base, & Funds for Infrastructure		F41: Unreasonable Regulation	
R15b: Infrastructure Trap: Need More Growth to Cover Infra Backlog		F42: Conservative Politics	
B16a: Industry Attracts Pop that Pays Taxes for Infrastructure		F43: Tightness of Fed Policy (people/jobs)	
R16b: But Increased Pop Increases Infra Load and Pressure for Taxes from Industry		F44: Cluster- Specific Retention Efforts	
B17a: Taxes from Industry Help Infrastructure		F45: attractiveness of competition	
R17b: Taxes from Industry Decrease Pressure for Incentives		F46: improve eff/eff	
B18: Running Out of Industrial Space			

IX. Appendix B: Shifts in the Value Chain Due to Disruptive Technologies

This appendix contains excerpts from, and a systems perspective on, “Skate to Where the Money Will Be” (Christensen et al., 2001).

Excerpts from “Skate to Where the Money Will Be”:

Disruptive technologies have caused many of history’s best companies to plunge into crisis and fail. ...

... prevailing orthodoxies [are] that companies should outsource all but their core competencies — that is, sell off or outsource any function that another company could do better or cheaper

But a different lesson comes from study of the evolution of company participation in the industry value chain in the presence of “disruptive technologies.”

... a key tenet of the concept of “disruptive technologies” [is] that the pace of technological progress generated by established players inevitably outstrips customers’ ability to absorb it, creating opportunity for start-ups to displace incumbents. ...

When sufficient information does not exist at an interface, managerial coordination will always trump market mechanisms, reinforcing the strength of integrated companies. ...

Once a modular architecture and the requisite industry standards have been defined, integration is no longer crucial to a company’s success. It becomes a competitive disadvantage in terms of speed, flexibility and price, and the industry tends to dis-integrate as a consequence. ...

Once industry standards are defined, the communication between links in the value chain can be mediated by market, rather than organizational, communication. Market mechanisms are viable when there is “specifiability, verifiability, and predictability.”

The bedrock principle is this: Those who control the interdependent links in a value chain capture the most profit. ...

Once an industry starts to fragment ... companies that design and assemble modular products ... face investor pressure to improve their return on assets but find that because they can’t differentiate their products or make them at a lower cost than competitors, they can’t improve the numerator of their ROA ratio. So they shrink the denominator; they sell off asset-intensive units that design and manufacture components But with perfect predictability, this pressure from Wall Street to boost ROA forces companies to skate away from the place where the money will be made in the future. ...

Disruptive competitors begin to move upmarket, and the power to make money shifts away from companies that design and assemble the end-use product toward the back end of the value chain to those companies that supply sub-systems with internal architectures that are still technologically interdependent. ...

In most markets, this power shift occurs tier by tier in a way that is quite predictable. Executives whose companies are currently making lots of money ought not to wonder whether the power to earn attractive profits will shift, but when.

If they watch for the signals, quite possibly they can prosper in all cycles, rather than in only one.

Note that this trend is not unique to high technology; Christensen gives examples for automobiles, banking, and university management education.

From a systems perspective:

We can take a systems point of view to understand why Christensen’s reasoning is valid. The shift from integration to modularization due to inexorable gains in technological capability is an example of “shifting loop dominance.” Feedbacks that promoted profits based on integration shift to feedbacks based on modularization.

This kind of shift answers the questions posed by Dennis Meadows in his presentation on “Shifting Dominance” (Meadows, 1997) as to what happens when

... after years of steady growth, organizations falter and sometimes fail?

... senior managers in these organizations, who are acknowledged as heroes in the press for their wisdom and success, seem to suddenly manage a series of failures that seriously damage their reputations?

The dominant loop is the one causal loop in a complex system that most influences the system’s behavior over some interval of time. After one loop has governed a system’s behavior for an extended period of time, it can occur very quickly, and sometimes imperceptibly, that the dominance shifts to another loop. When that happens, the habits, the senior personnel, the policies, the data and control systems, the criteria for success, even the mythology of the firm may become irrelevant or counterproductive.

Such shifts have killed many once-prosperous companies and management is well-advised to be on the lookout for them.

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