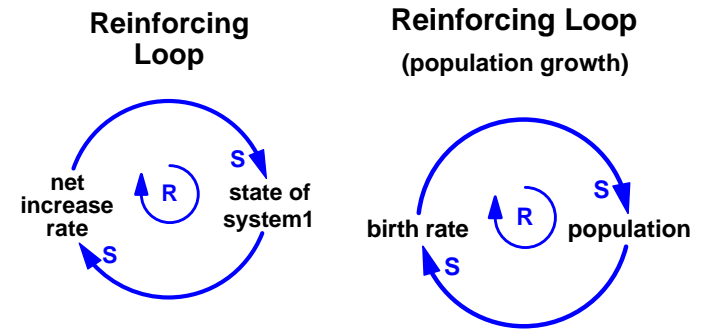
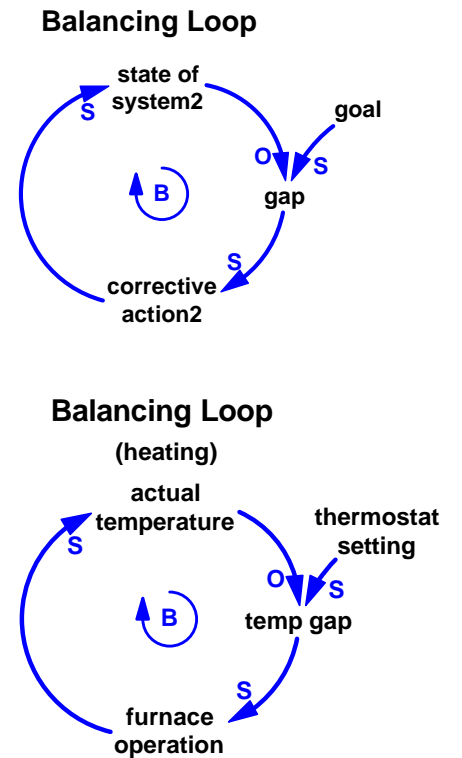


Systems Thinking Archetypes (Generic Structures)

<u>Archetype</u>	<u>Behavior</u>	<u>Examples</u>	<u>Policy Advice</u>
Reinforcing Loop	<ul style="list-style-type: none"> • growth or decline of the "state of the system" 	<ul style="list-style-type: none"> • Population growth or decline • Sales growth or decline • Microphone feedback 	<ul style="list-style-type: none"> • recognize that reinforcing feedback creates exponential growth that can bring on pressures to retard growth • they are two-edged swords that can work for us or against us



Balancing Loop	<ul style="list-style-type: none"> • goal seeking • regulates system behavior • opposes system change from set target or goal 	<ul style="list-style-type: none"> • Heating or cooling system; setting thermostat to regulate room temperature • Economic growth; Federal Reserve modifying interest rates to meet growth target 	<ul style="list-style-type: none"> • recognize that balancing loops regulate the system to provide stability and, on the other hand, resist change
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Archetype Behavior

Limits to Growth

(at right are two forms of this structure)

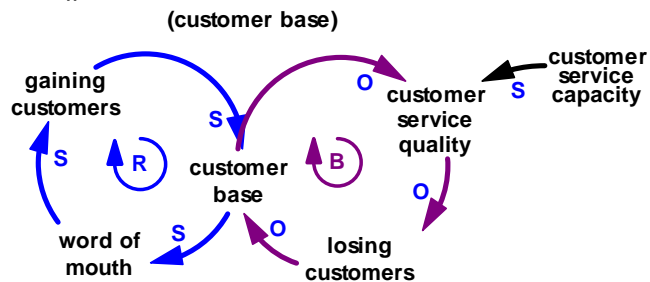
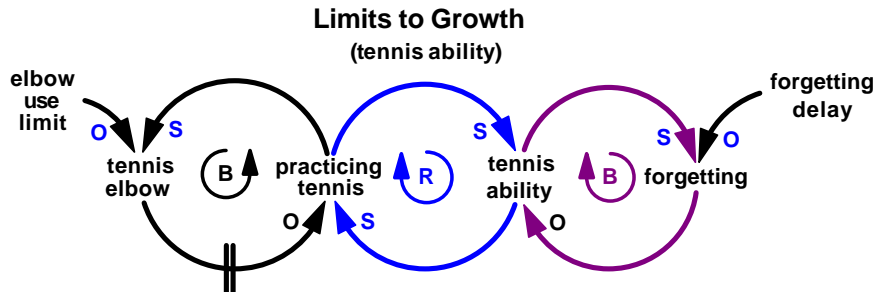
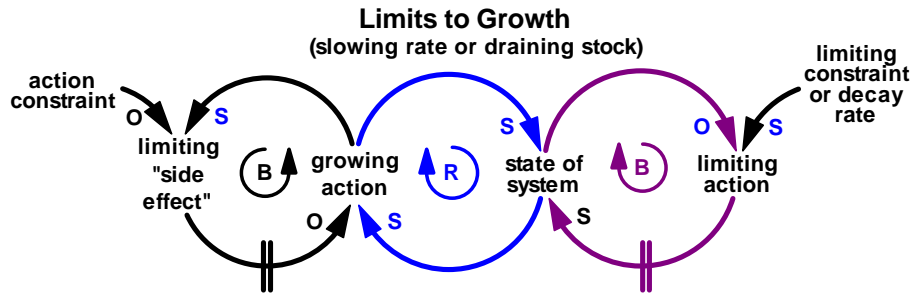
Initial growth in the "state of the system" is eventually limited due to approaching a limiting resource constraint or the due to a draining action. Also, the rate of growth can be slowed by a growing action constraint due to a "side effect" of the growing action.

Examples

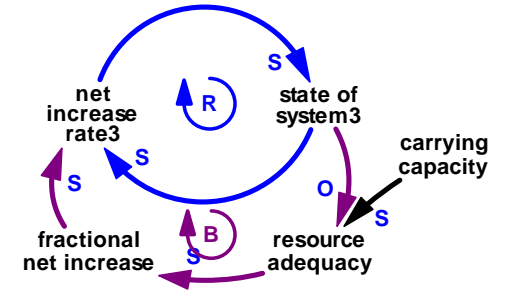
- Sales limited by service quality
- World population growth limited by resources
- Ability to practice tennis limited by wear & tear on the elbow or by losing ability from forgetting.

Policy Advice

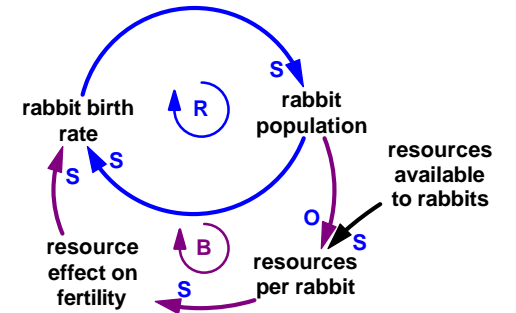
- recognize that nothing grows forever
- be aware of future limits and the pressures they will cause
- leverage for growth is often in looking for ways to reduce or remove the limits, rather than by pushing harder on the growth loop



Limits to Growth
(approaching carrying capacity)



Limits to Growth
(rabbit population)



Archetype Behavior

- Fixes That Fail**
- actions produce the desired correction in the short-term, but have make the problem worse in the long-term
 - typically a result of addressing problem symptoms rather than root causes

Examples

- taking drugs (whether narcotics or pain-relievers) may make a person feel better immediately, but does not address root causes and makes one feel worse in the long run
- corporate downsizing reduces costs immediately, but impairs the organization's ability to perform in the future
- road-building relieves traffic congestion in the near-term, but attracts more growth to again build up congestion; the larger area also makes existing public transportation inadequate

Policy Advice

- look for unintended consequences of actions to relieve painful symptoms
- look for root causes that are responsible for the symptoms
- when addressing symptoms, look for ways to reduce negative impacts
- take action to both relieve immediate pain *and* work on long-term root causes

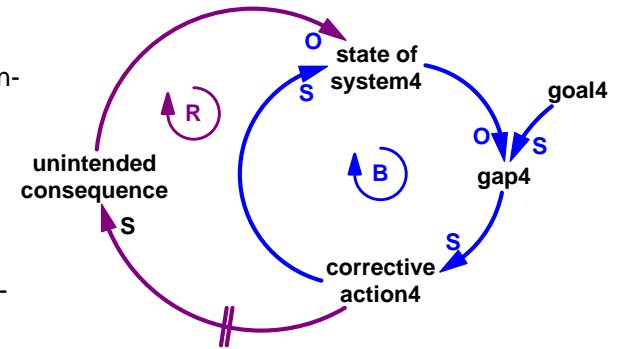
Addiction

- occurs when the short term solution has to be taken again and again because the effect wears off
- the need to take recurring action acts to drive the "Fixes That Fail" dynamic
- exacerbates the effects of the "Fixes That Fail" dynamic

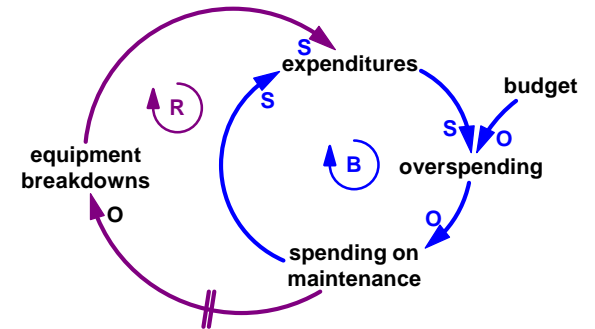
- addictive drugs wear off and a person needs more; they damage body and mind
- expediting deliveries negatively impacts other products which must also be expedited and they interfere with normal working of the production & distribution system
- city growth and development without impact fees leads to infrastructure backlogs and the need for more growth & development

- same as for "Fixes That Fail"

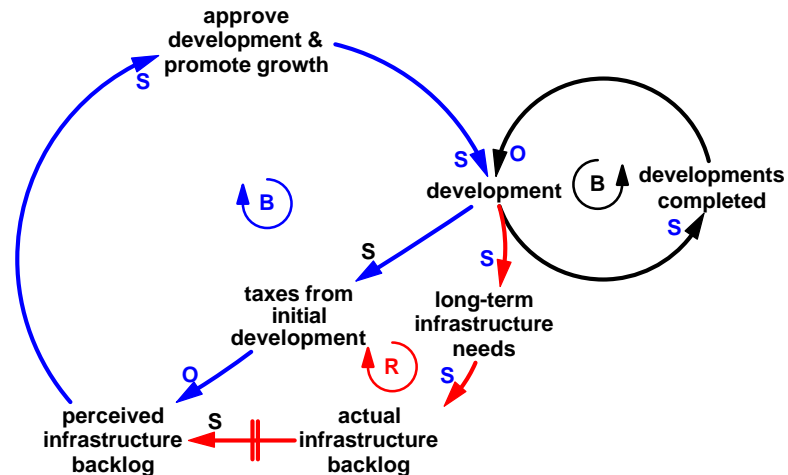
Fixes That Fail



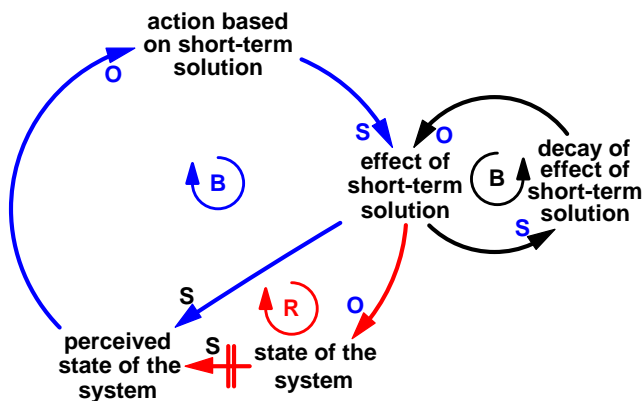
Fixes That Fail (maintenance budget)



Addiction (growth)



Addiction



Archetype Behavior

Shifting the Burden

- actions taken to reduce symptoms reduce the ability to take action for the long term.
- can be either shifting the burden to short-term, rather than long-term, solutions or shifting the burden to an intervenor, rather than to building system capability
- not only exacerbates the effects of the “Fixes That Fail” dynamic, also it reduces the ability to take action for the long term and escape symptomatic solutions

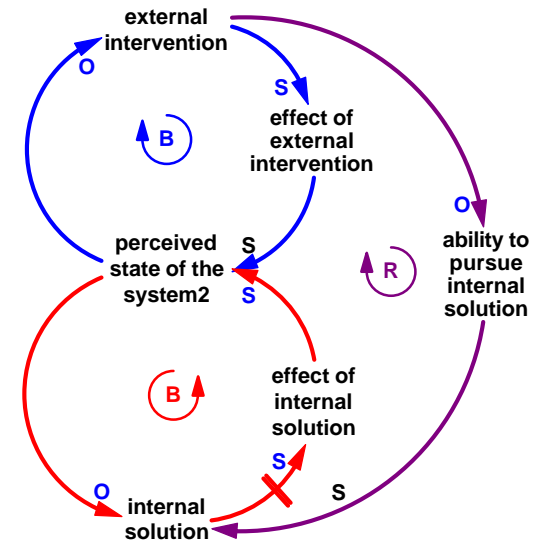
Examples

- taking drugs makes a person feel better but reduces ability to improve life skills
- giving a man a fish vs. teaching a man to fish promotes dependency
- corporate downsizing reduces costs immediately, but reduces the ability to develop new products
- HR deals with a manager’s problem with low employee performance, rather than assisting and training manager
- government insures bank deposits and bails out banks rather than requiring sound banking practices

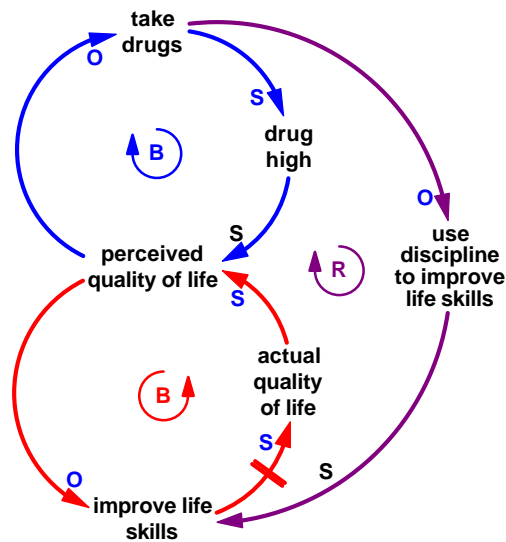
Policy Advice

- same as for “Fixes That Fail”

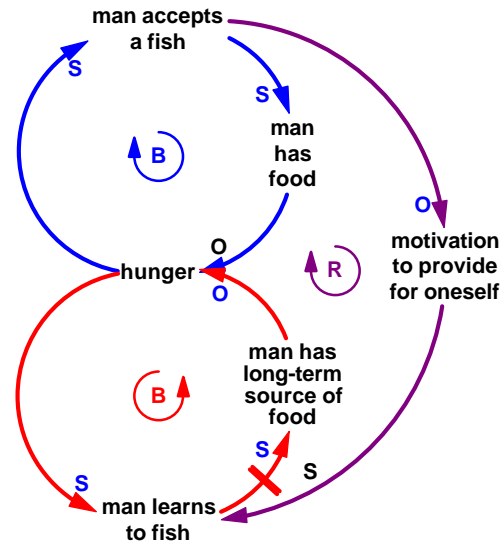
Shifting the Burden (to an external intervention solution)



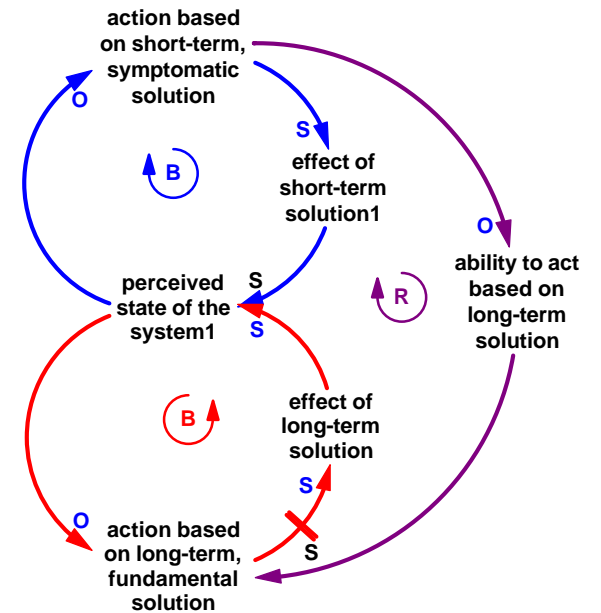
Shifting the Burden (drugs to treat the short-term symptom)



Shifting the Burden (charity external intervention vs. teaching self-reliance)



Shifting the Burden (to the short term, symptomatic solution)



Archetype Behavior

Examples

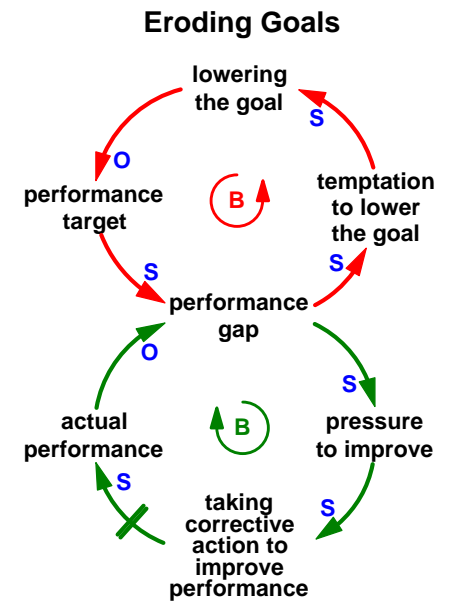
Policy Advice

Eroding Goals

- there are two ways to close the performance gap:
 - improve performance
 - lower the goal
- also known as the “boiled frog” syndrome

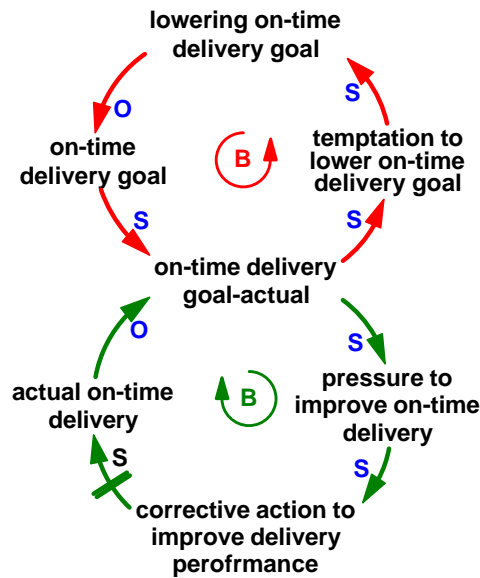
- it’s easier to lower quality targets than increase quality
- it’s easier to let federal budget deficits keep rising than to increase taxes and/or decrease spending
- it’s easier to relax environmental standards than reduce pollution

- when performance is declining, examine whether it could be because goals are being relaxed
- make goals clearly visible
- examine the way goals are set and who sets them
- goals located outside the system are less vulnerable to erosion
- reward setting “stretch” goals & don’t penalize if not met, which teaches people to not set stretch goals.



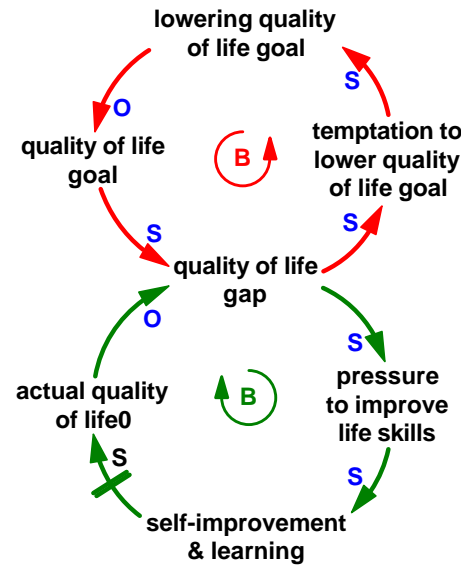
Eroding Goals

(on-time delivery)



Eroding Goals

(quality of life)



Archetype

Behavior

Examples

Policy Advice

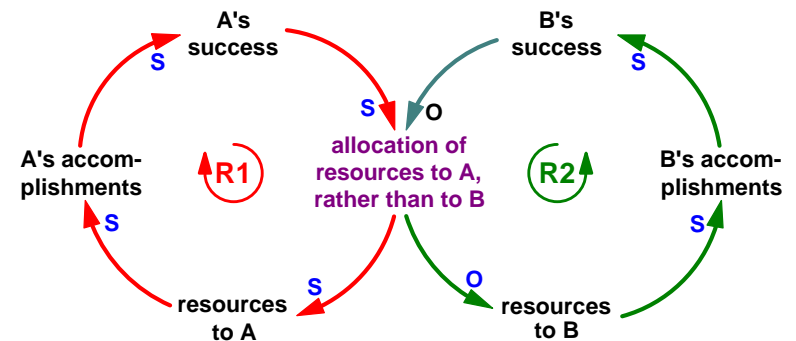
Path Dependence or "Success to the Successful"

- once one entity (person, product, organization, company, or country) gets ahead, it's easier to get even further ahead because better performance provides more resources and a greater ability to improve performance
- a "figure 8" is a reinforcing loop

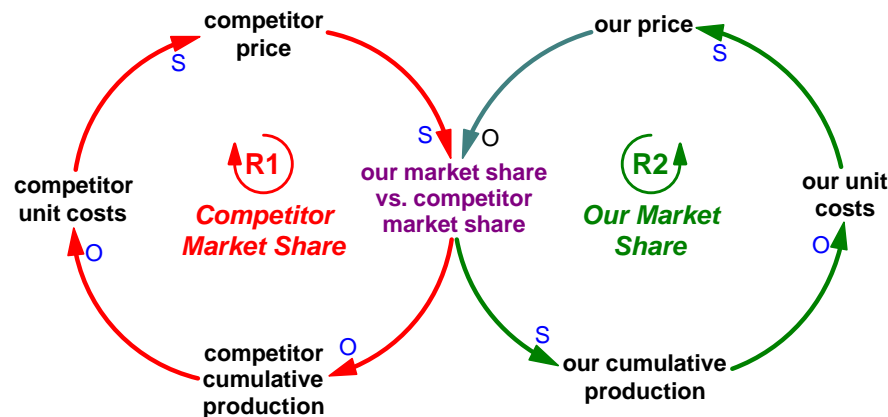
- the "rich get richer ..." phenomenon
- monopolies increase market share (but reduce competition)
- economic cluster formation
- "good student" performance over "bad student" performance
- home vs. work involvement
- manufacturing improvement favored over engineering because it's faster and easier

- understand that this structure requires intervention to produce and maintain a "level playing field"
- examine how the system has been set up for "winner-take-all" competition.
- find ways for teams to collaborate rather than compete

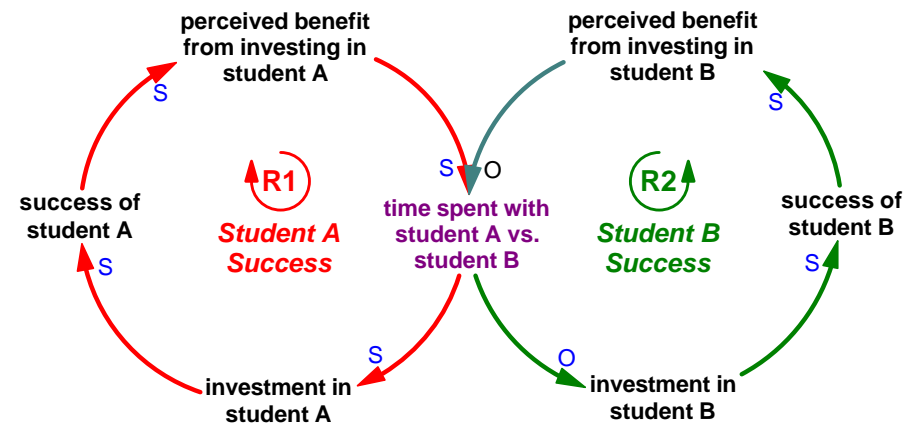
Path Dependence or "Success to the Successful"



Path Dependence Example: the "experience curve."



Path Dependence Example: self-fulfilling prophecy for student success



Archetype Behavior

- Escalation
- individual action that attempts to increase security or performance at the expense of another (e.g., a competitor) results in less security or decreased performance over the long run.
 - this structure is brought on by unbridled competition and can only be escaped by promoting cooperation based on mutual interests
 - a "figure 8" is a reinforcing loop

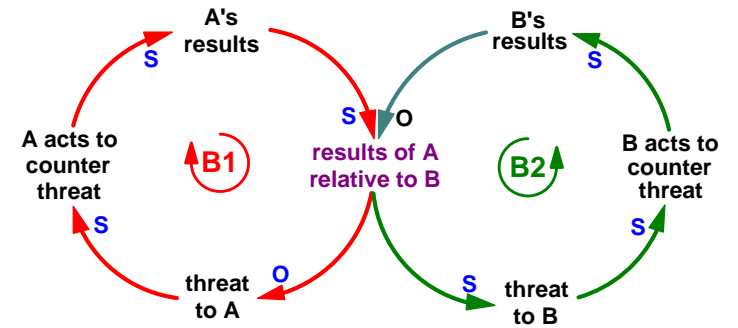
Examples

- arms race increases weaponry (but decreases security for all)
- price wars increase sales and market share (but decrease profits for all)
- regions compete on the basis of low taxes & less regulation for a limited number of jobs (but leads to infrastructure backlogs for all regions)
- cities compete for sports teams based on expenditures to support the teams (but leads to "build us a stadium or we go elsewhere" blackmail and higher costs for all cities)

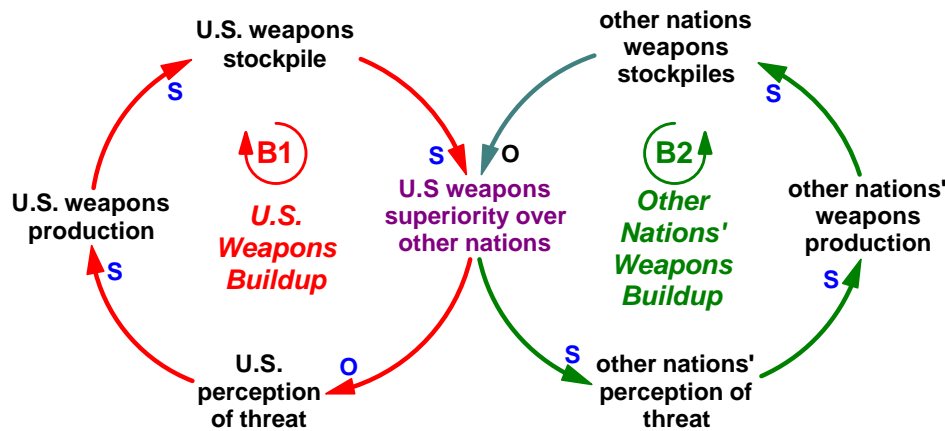
Policy Advice

- understand that overcoming this structure requires cooperation toward a larger goal that benefits competing parties
- examine how the structure reduces results in the long run (e.g., in an arms race there is less security)
- examine whether perceptions of opponent's intent is accurate (perhaps they see themselves as simply responding to *your* action)
- examine whether perceptions of opponents ability is accurate (e.g., perhaps their arms potential is not as great as perceived)

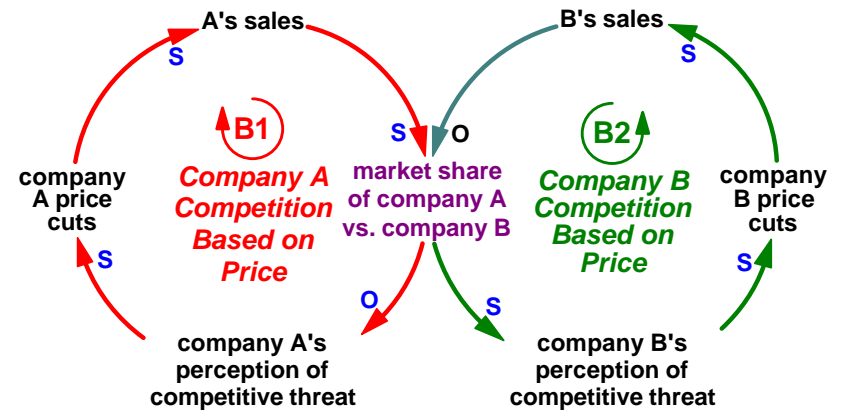
Escalation



Escalation Example: the "arms race"



Escalation Example: price war

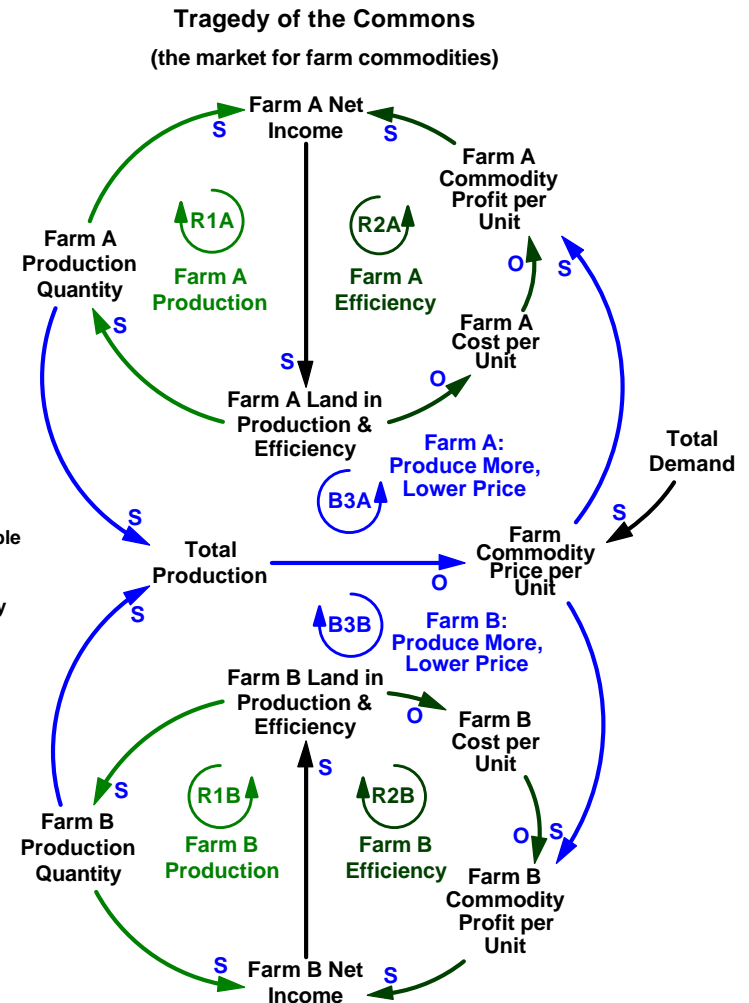
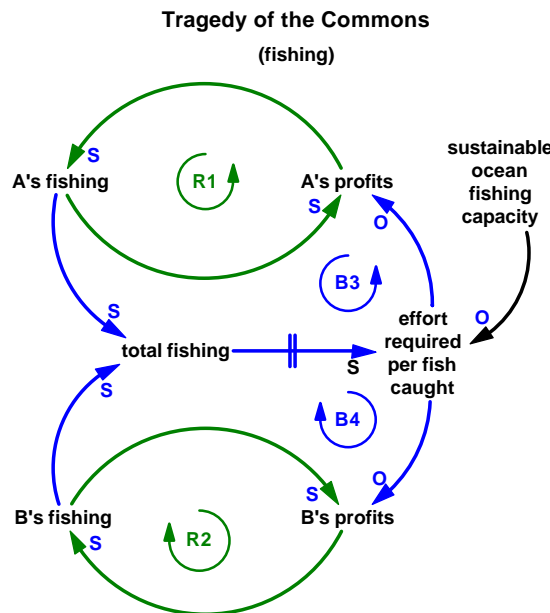
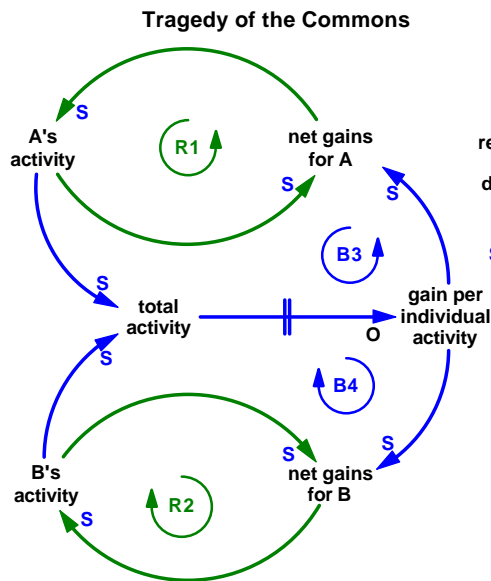


Archetype Behavior Examples

- Tragedy of the Commons
- rational action by individuals to improve individual performance results in destroying the ability of the whole system to perform and also destroys the ability of individuals to perform as the system is destroyed.
 - overgrazing on land destroys the land's ability to grow feed
 - overfishing depletes the fish stock and the ability of fish to reproduce ... in this case the "market" signal is increased price, which leads to even more fishing and more rapid destruction of the commons
 - increasing individual farm production by increasing land in production and improving technology has the goal of increasing farm income ... but the increased supply in the presence of inelastic demand decreases prices so all farmers go broke without government subsidies or small farmers get bought out by larger farmers (which does not decrease the supply of land)
 - groups benefit more from getting more resources from a common organizational resource pool, but overload the common resource (e.g., quality, HR, reproduction services)
 - individual engineering teams maximize the electrical functions they're designing by drawing more on the electrical power system, but overall exceed the electrical system's ability to supply power
 - firms benefit from economic activity that causes pollution, but increase negative health impacts for all
 - developers profit from more development that uses common infrastructure, but overwhelm infrastructure

Policy Advice

- understand that overcoming this structure requires cooperation toward a larger goal that manages common resources and benefits competing parties
- apportion the expense of long-term collective loss to individuals or limit individual activity (grazing fees, fishing limits, land allowed in production, development impact fees)



Archetype

Behavior

Examples

Policy Advice

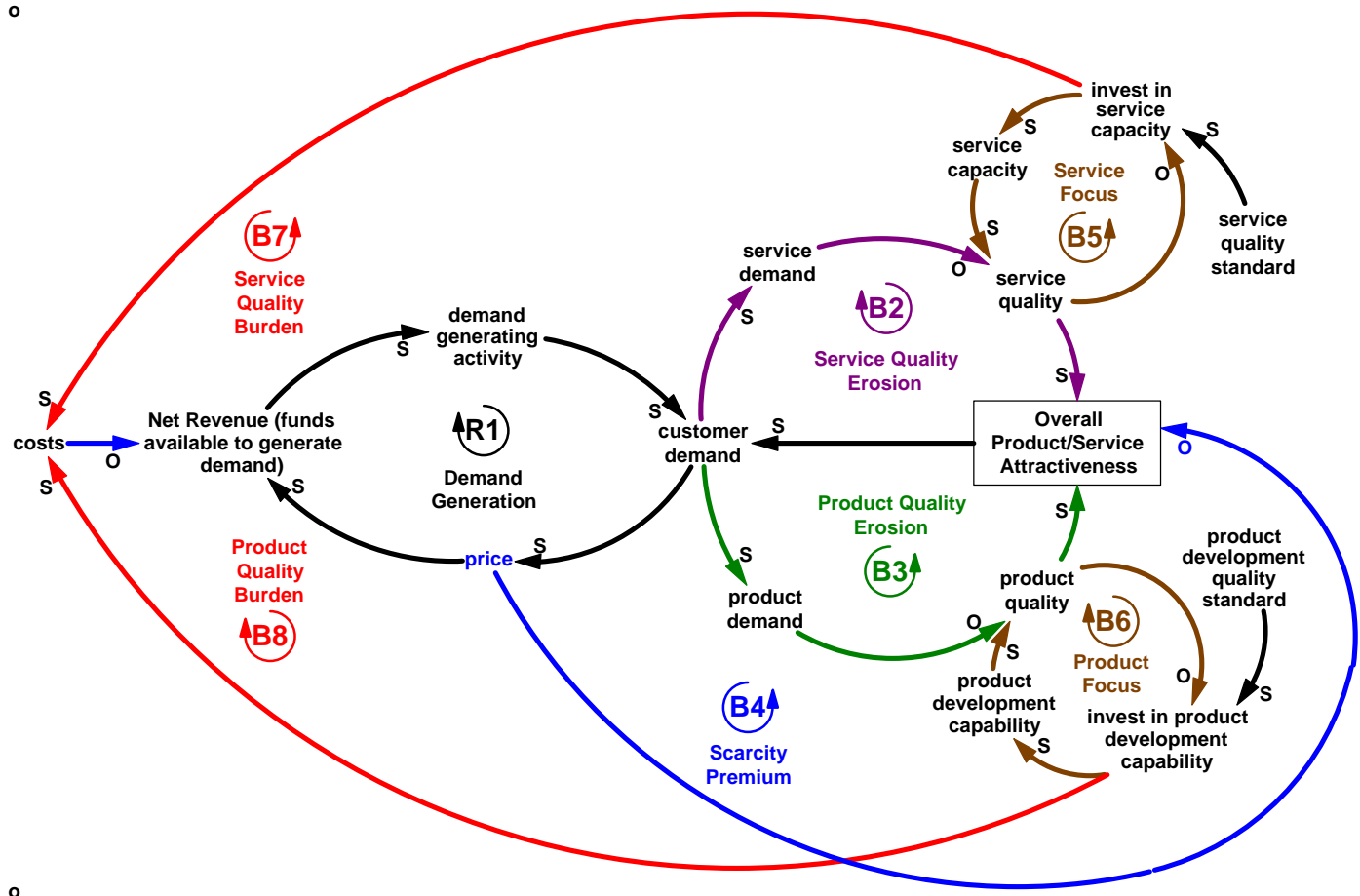
The Attractiveness Principle

(this diagram is shown with the typical price, service quality, product quality features, but there are others, (e.g., delivery delay, community participation / citizenship)

- a growing action encounters multiple “Limits to Growth”
- addressing one limit puts more pressure on other limits
- As Forrester said, “There are no utopias in social systems.”

- no company can be all things to all people (lowest price, best product, best service); it must decide and focus on its “value proposition”
- no region can be all things to all people (lowest taxes, lowest housing prices, best quality of life, best jobs)

- practice “strategic unattractiveness” ... that is, decide on the features that will make the product or region less attractive and balance out the attractiveness of the other features that are more desirable to customers or the other features that are necessary to support the organization’s purpose/mission.



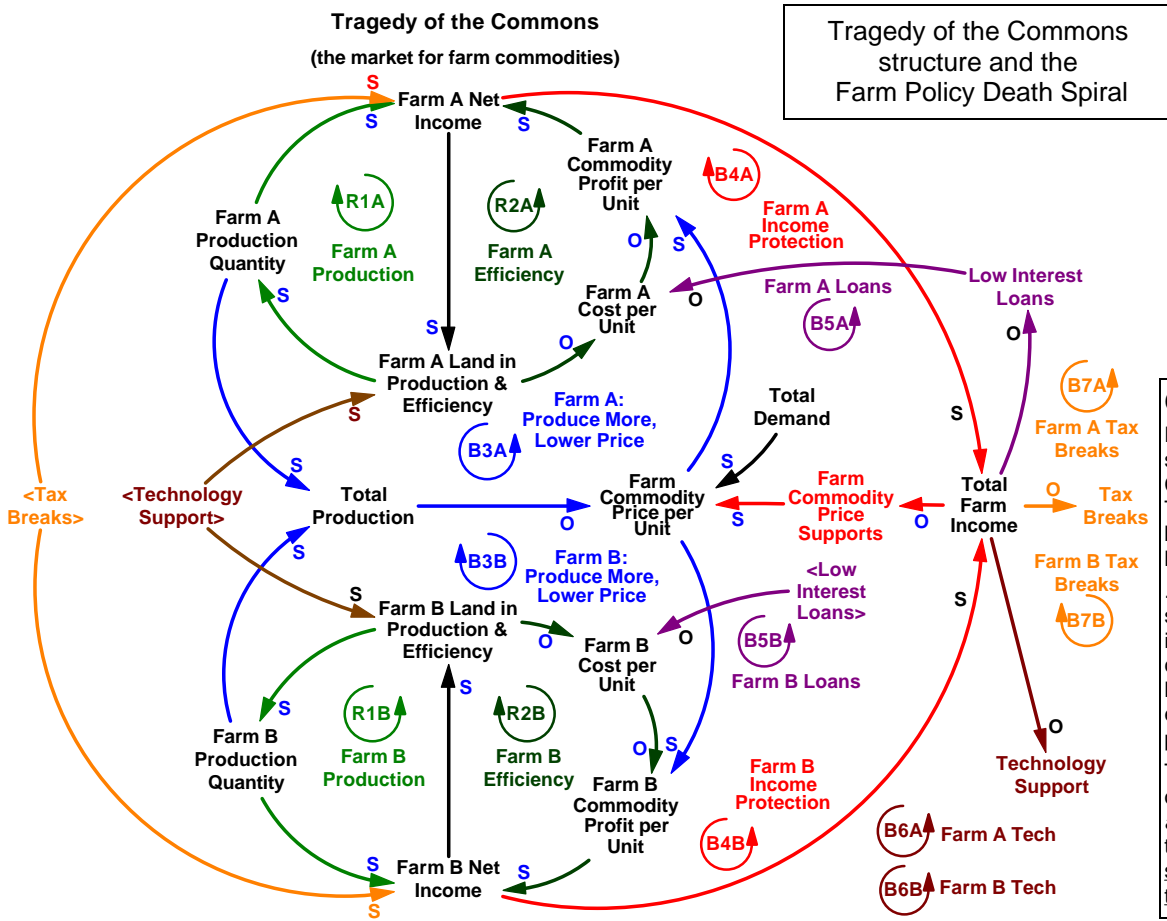


Figure 16. Government Outlays by Source, 1994-2001.

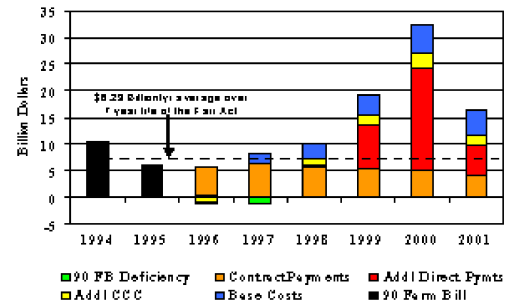


Chart: Trends in Government Farm Supports

Darryll E. Ray, agricultural economist with the Agricultural Policy Analysis Center at the University of Tennessee, testified before the House Committee on Agriculture on 2/14/01 on "Crop Agriculture Faces Long-Term Price and Income Problems," (see excerpts from his testimony below; italics and underlings are as in his original). <http://agriculture.house.gov/hearings/h10214w2.htm>

... our response to the subsequent downward spiral of crop agriculture suggests that we are in denial. We are in denial that anything long-term is to blame for the devastatingly low prices and low market incomes in crop agriculture. We are more than willing to blame agriculture's problems on the Asian Crisis, exchange rates, energy prices, or anything else that comes along. Others blame the level of loan rates, emergency payments, crop insurance, etc., etc.

The implication being that: once the—you-name-it-disruption—subsides or is remedied, agriculture will be just fine. *That is nonsense.* There are *always* disruptions. There are disruptions in agriculture, the auto industry ... every industry. At this stage of the farm policy debate, discussion should not center on this or that disruption, but on the ability of agricultural markets to make adjustments irrespective of the exact nature of

the disruption. Other industries self-adjust. Why doesn't crop agriculture? That is the real question.

This time in history and this stage of the farm bill debate cycle provide the perfect opportunity to make a definitive determination of the how the grain markets work. For the first time in nearly seventy years, markets have been free to reveal the true supply and demand behavior of U.S. crop markets.

I believe that the market experience of the last four years shows that crop agriculture is just as prone today to chronic price and market income problems as it was when farm programs were instituted decades ago. My mission in this testimony is to explain why I believe that is so.

Agriculture's price and income troubles are quickly understood by considering a) the rate of

growth of crop supply compared to crop demand and b) the price responsiveness of supply and demand.

Total crop acreage (supply) is unresponsive to price declines in short or longer-run.

Farmers have no incentive to reduce production as prices decline. From an individual farmer's standpoint, there is no rational reason for him/her to leave land idle because crop prices have declined ... Each farmer produces too little to affect total supply and therefore price, so any reduction in his output means less revenue. ...

Demand is unresponsive to price changes.

Because it is essential for life—like insulin for a diabetic—price is of little consequence. Food comes first. We will pay whatever is required to obtain it. But once we have enough, will not buy

significantly more total food, no matter how far the collective price of food has dropped. Is this true for other products? Of course not.

Typically, a price drop greatly expands the quantity demanded of an industry product. ...

Agriculture is unique. Much of that uniqueness is rooted in two characteristics: (1) cropland will be used to grow crops and (2) food is essential for life but the quantity needed is finite. These and other supply and demand characteristics virtually assure that there will be little change in total crop acreage and little change in the quantity demanded as prices fall, even by 40 percent over a four year period.

Periodically, crop exports will grow for several years at relatively high rates, but usually they do not. Technological advances in crop agriculture, most of which is directly or indirectly

possible because of taxpayer support, assures relatively rapid shifts in supply. Under this combination of price unresponsive supply, price unresponsive demand and supply shifting faster than demand, prices and income can be expected to be chronically depressed. This is not a short-run problem.

Left to itself, crop agriculture would continue its downward spiral, bankrupting successive farmers on a given piece of land, forcing bank foreclosures, and, in general, wreaking devastation on ALL rural areas. It would be a disaster of a magnitude that would be well beyond political acceptability. Those that believe otherwise also believe that supply and demand quickly adjust to lower prices. If that were true, then crop agriculture would self-correct. But it is not and agriculture doesn't. It really is that simple.