Conducting and Understanding a Trend Analysis

Preparatory Step: Finding the Data

Regional planners, government officials, and local commissions all compile data about your community, and they should have it readily available. Some members of the stakeholder probably have access to some basic trend data, or know who to call to get it. To identify the data you need, you should look at the needs and assets you have been studying, and list the variables that relate to whether or not the needs are being met.

The next step is to determine as a group where you can find data on each variable. Assign the task of gathering the data to individuals who have the time to pursue it during business hours, and who can be counted on to follow through.

Sometimes, however, data for some or many needs will simply not be available. In this case, use what you have, which will sometimes be nothing other than the perceptions of the stakeholders. This is OK. The goal, after all, is to explore a topic rather than conduct a scientific analysis. This is a worksheet that can help you organize the information:

Goals	Assets	Variables	Data Sources
In 2040, all local employers provide living-wage jobs, and have used our city's natural beauty to attract tourists to engage in activities that enhance health and well-being.	Employers Health Businesses Natural Areas Tourism Opportunities	Growth in tourism Changes in income Park and recreational development	U.S. Census Chamber of Commerce Recreation Departments Tourism Bureau

Understanding Trends

Analyzing trends can help you to think intuitively instead of logically, ask questions that don't come up otherwise, and see buried linkages. For these reasons, when engaging in this exercise you will want to feel free to let the conversation wander "off topic". This flexibility may lead to insight into why your community's needs are recently being met more effectively, or how a particular community goal might help people satisfy needs that are going unmet**.**

Step One: Chart Community Assets Over Time

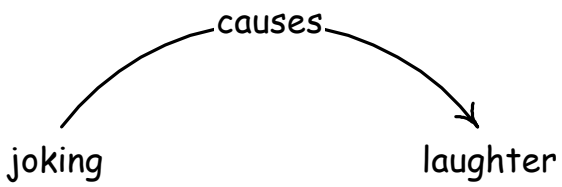
For each variable you have identified, try to find what has been happening in that area over the last five, ten, twenty, fifty years, and draw a graph that shows the trend line of that time period. These do not need to be accurate graphs ready for production. Plot them quickly on flip-chart paper or a chalk or white-board. The goal is to get a conversation going. As you plot the variables associated with each asset, begin asking the group the following questions:

- What are the trends you are seeing?
- Are all the variables associated with each need changing in the same direction?
- Are things changing at an increasing rate?
- Is there a roller coaster, boom and bust pattern at work?
- What might these patterns mean?

One of the objectives of analyzing trends is to discern patterns of behavior, their underlying causes, and the forces at work to keep the system in a state of change or, conversely, at equilibrium. Language and mapping processes developed by systems analysts can graphically illustrate the different components of a community system working dynamically together. Even simple systems can be better understood by grasping the key concepts of links, feedback loops, behavior over time, and archetypes. These concepts— the language of systems— are described in more detail in the following sections.

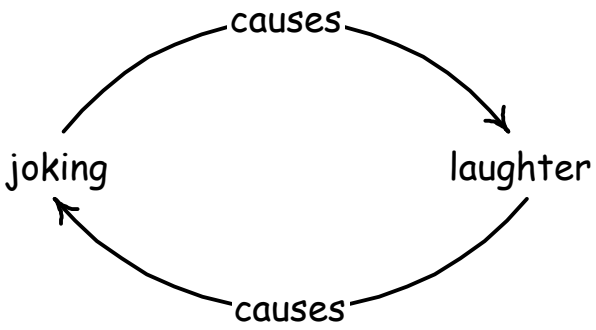
Cause, Effect, and Feedback Loops

The logic of cause and effect is one of the fundamental relationships described by the language of systems. When one element in a system influences another element, an arrow is drawn that links the elements in a cause-effect relationship. This arrow, or link, is known as feedback.



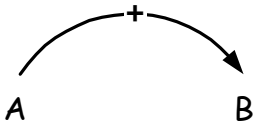
In maps or drawings of these relationships, intricate webs of causes and effects develop as the various elements in the system influence each other.. The study of systems dynamics reveals that cause and effect do not necessarily form a linear process, but can often be cyclical.

This has led people involved in such analysis to rethink cause and effect completely, calling it, more accurately, *causeffect*. This illustration demonstrates the most basic type of system: a closed loop. The feedback in this system forms a closed loop, so that the original cause becomes the effect.

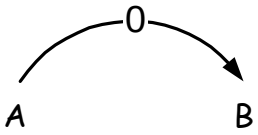


Feedback in the Same and Opposite Directions

Feedback in a system doesn't always take the same form as the original influence. If an influence on a system causes another part of the system to change in the same direction, then this is illustrated with a + sign. For example, if an increase in A causes an increase in B, then this would be drawn as a + feedback loop, as shown in the illustration below. So, if point A represented the first domino and B represented the second domino, then the push given to the first domino would cause the second domino to fall over in the same direction. This is known as *positive feedback.*

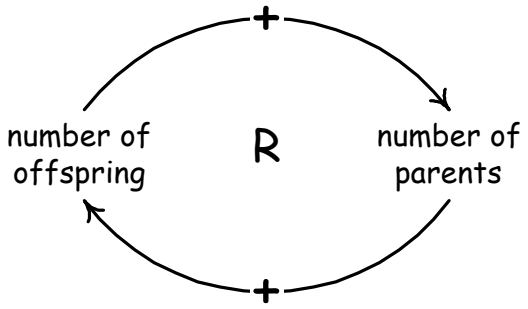


If the change that is occurring in the system goes in the *opposite* direction as a result of a specific action, then this is drawn as a 0 sign. For example, if I sit on one side of a teeter-totter, then the other side will rise *up* while my side goes *down*. This is known as a *negative feedback loop.*

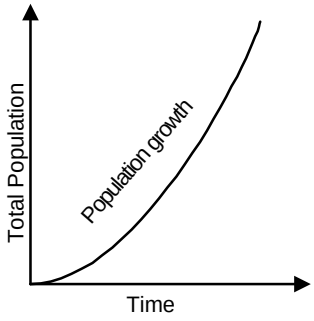


Reinforcing Feedback Loops

The most simple pattern in systems is the *reinforcing feedback loop* where each action reinforces the movement of the system in the same direction. So, if the system is changing in a positive direction, reinforcing feedback will amplify its change in a positive direction. If it is changing in a negative direction, reinforcing feedback will amplify its change in a negative direction. Reinforcing feedback loops that occur in the world often behave as exponential functions over time, like compound interest or population growth. If a phenomenon is observed to be expanding at an increasing rate, you can be reasonably sure that there is a reinforcing feedback loop at work. Population growth for any species in an ecological setting is a good example of this.



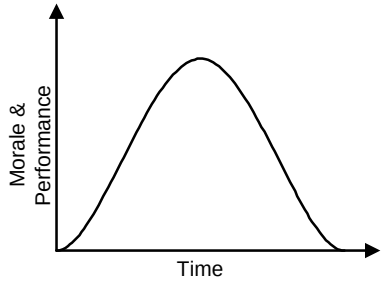
Graphed over time, the reinforcing feedback loop is an exponential function, as shown in the figure below. There are many examples of this: global warming, suburban sprawl, and traffic congestion, to name a few. If you see a trend that demonstrates an exponential function, you should strive to identify the variables that are reinforcing each other if you want to find ways to effectively intervene in the system.



Population growth is an easy example, because of the limited number of variables involved. But can you imagine what it might be like trying to determine the variables that account for suburban sprawl?

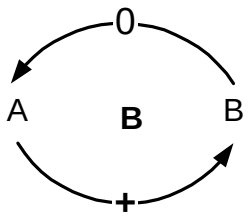
Reverse Reinforcement

Something may happen to make a positive reinforcing loop turn into its opposite, a negative reinforcing loop. For example, if an organization's members perceive it to be doing well, then the goodwill and high morale that comes from that perception can make them perform even better. But if something happens that changes their perception to a negative one, then low morale can cause the members to perform worse and worse, in a negative reinforcing cycle. The figure below shows how this reversal of fortune might look over time.

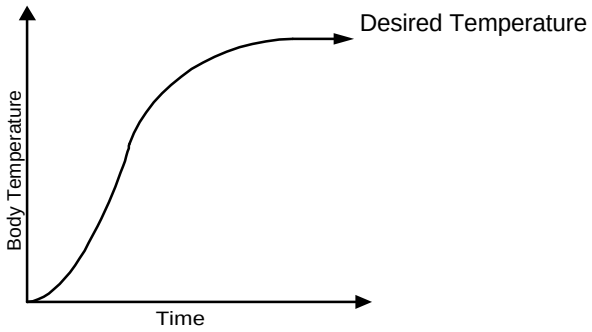


Balancing Loops

The second type of simple systems pattern is a *balancing loop*. A balancing loop seeks equilibrium, so that the action within the system will work to bring the system to either its original or its target condition. If there is an increase in A that increases B, then the increase in B will cause A to decrease. It is depicted here:

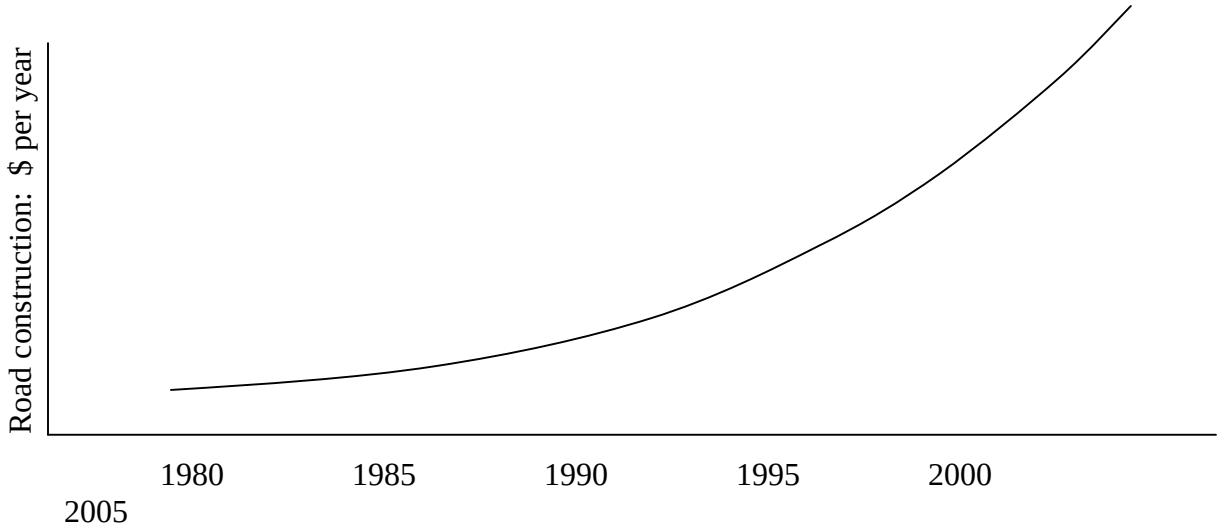


One example of a simple balancing loop is the way our bodies regulate internal temperature. If we get too hot, we perspire to cool off. If we get too cold, we try to warm up. The effect of this balancing process over time is illustrated in this illustration:



Community Trends and Feedback Loops

Understanding these dynamics, it is possible to start to identify what might be at work behind the trends in your community.
Here is example of a current trend from an urban area with respect to new road construction.

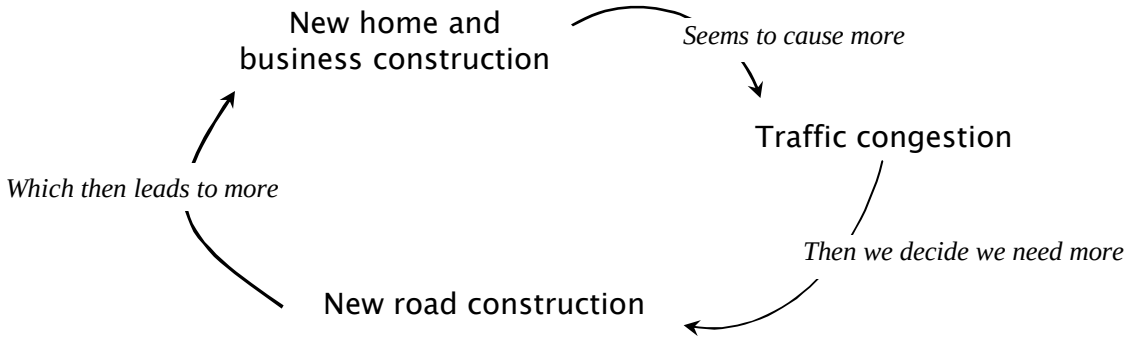


This is interesting – the rate of growth might suggest that there is a reinforcing system at work behind the trend toward increased spending on road construction. What might the variables be?

Economic growth? New business and home construction? Traffic congestion?
Capital budgets in cities and states? Federal road programs?

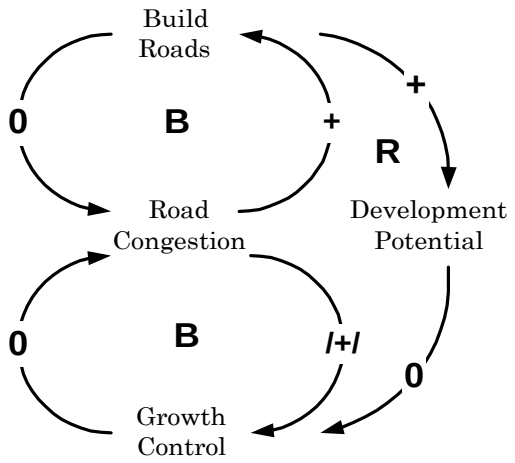
Step Two: Identify Relationships between Variables

Once you've identified some of the variables at work in the trend, try to draw them in ways that are connected to each other.



Step Three: Identify Patterns of Behavior that Match Common Archetypes

Here, you need a mega-map on a wall, and extra paper for multiple approaches. You can tape pages onto it that contain graphs of important trends, and use this as an exercise to see how the group views the trends as relating. Then, with a facilitator drawing lines, let the group brainstorm all the linkages, and how they might be influencing each other. In the diagram below, planners figured out that the new road construction process in their town was driving suburban sprawl. Rather than build new roads to manage traffic congestion, they needed to think harder about how to manage residential growth.

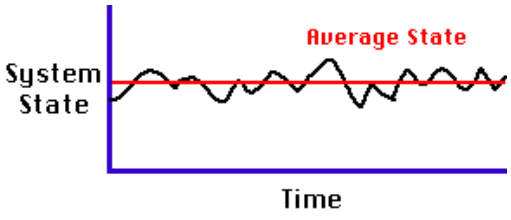


As it turns out, this pattern of behavior matches a system archetype known as Shifting the Burden. In this situation, attacking a problem without dealing with its real cause actually makes the problem worse.

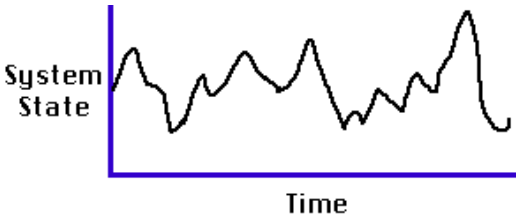
Equilibrium

Another common pattern is a system in equilibrium, with variables at work that maintain it in its current state, and thus resistant to change. To effect change here, you must identify what the variables are that are keeping things in balance. Over time, equilibrium can take many forms:

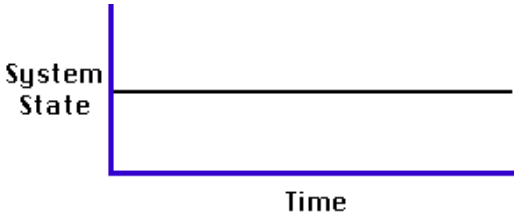
Steady State Equilibrium



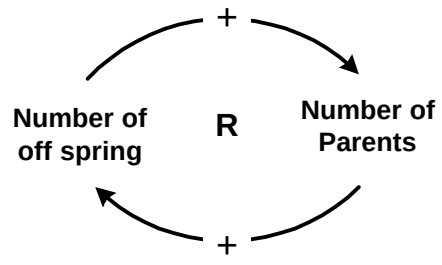
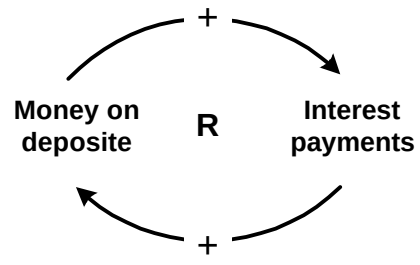
Dynamic Equilibrium



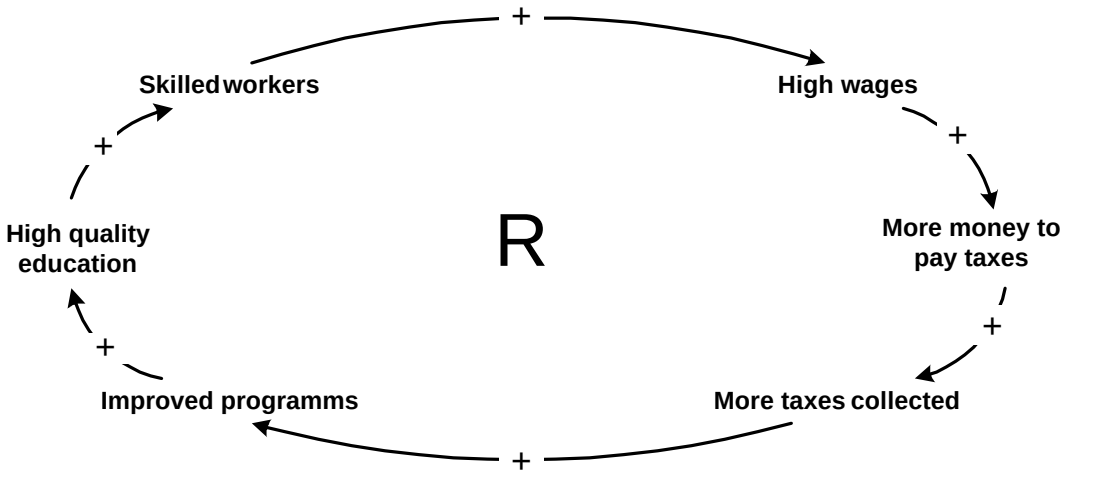
Static Equilibrium

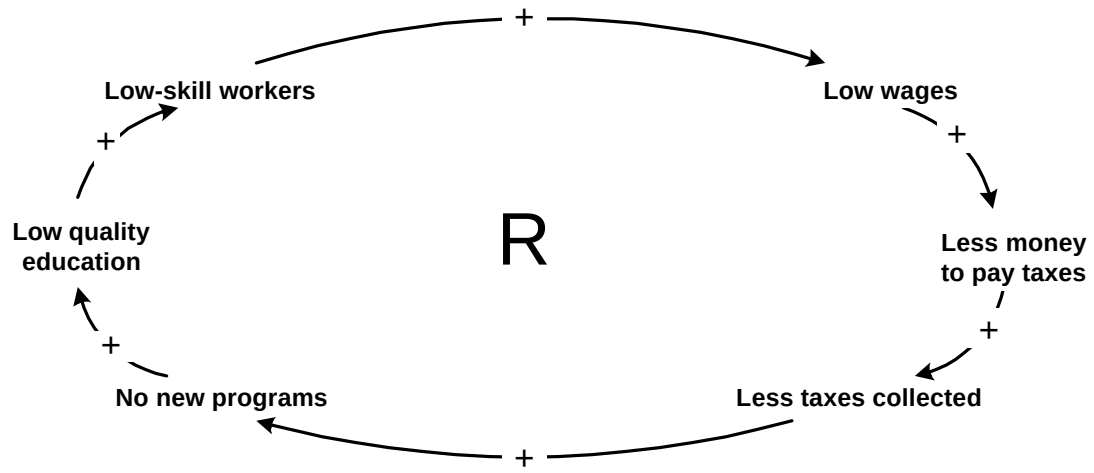


Common Community Archetypes

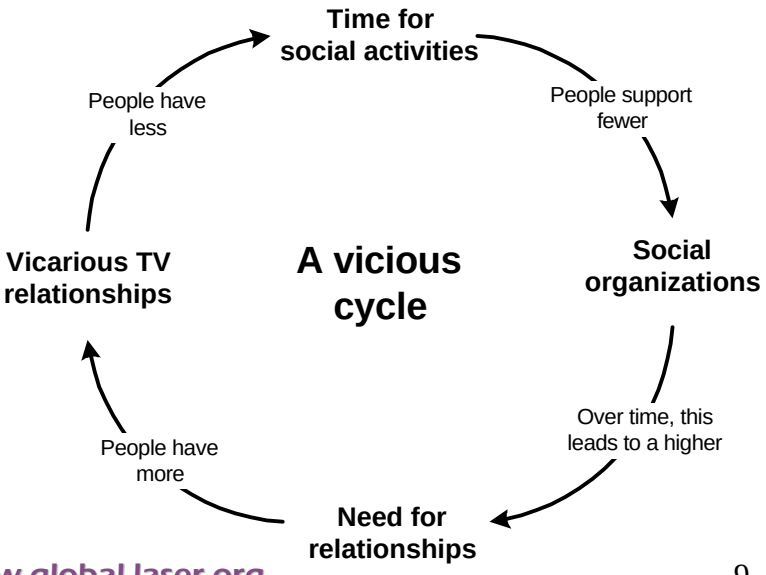
	Vicious Cycle	Virtuous Cycle
General Description	The variables feed off each other in a way that is making the system spiral out of control.	The variables work together to cause the system to continually improve itself.
Examples	1. The population is exploding because more parents are producing more offspring that are becoming parents. 2. The school system is low quality because people object to increasing taxes.	1. Money on deposit in a bank gains interest and increases net worth. 2. The schools are high quality, and graduates have good job opportunities.
Mental Models	1. Birth control is immoral. The more children I have, the more it proves that God loves me. 2. The school was good enough for me when I was growing up. Those teachers make too much money anyway.	1. Saving money will help me prepare for the future. Money on deposit needs to earn a rate of interest that keeps up with inflation. 2. Education is important for our children's future. It is worth the sacrifice to pay the costs.
Leverage Points	**1. Paradigm Change:** Help people understand that controlling global population is critical to human survival. **2. Turn it Around:** Introduce school programs with external funding to increase job skills.	**1. Add Positive Reinforcement:** A culture of saving can improve economic security. **2. Consider Alternative Funding:** Find ways to make education less expensive, so that support doesn't erode over time.
System Diagrams		

Intelligence Pays

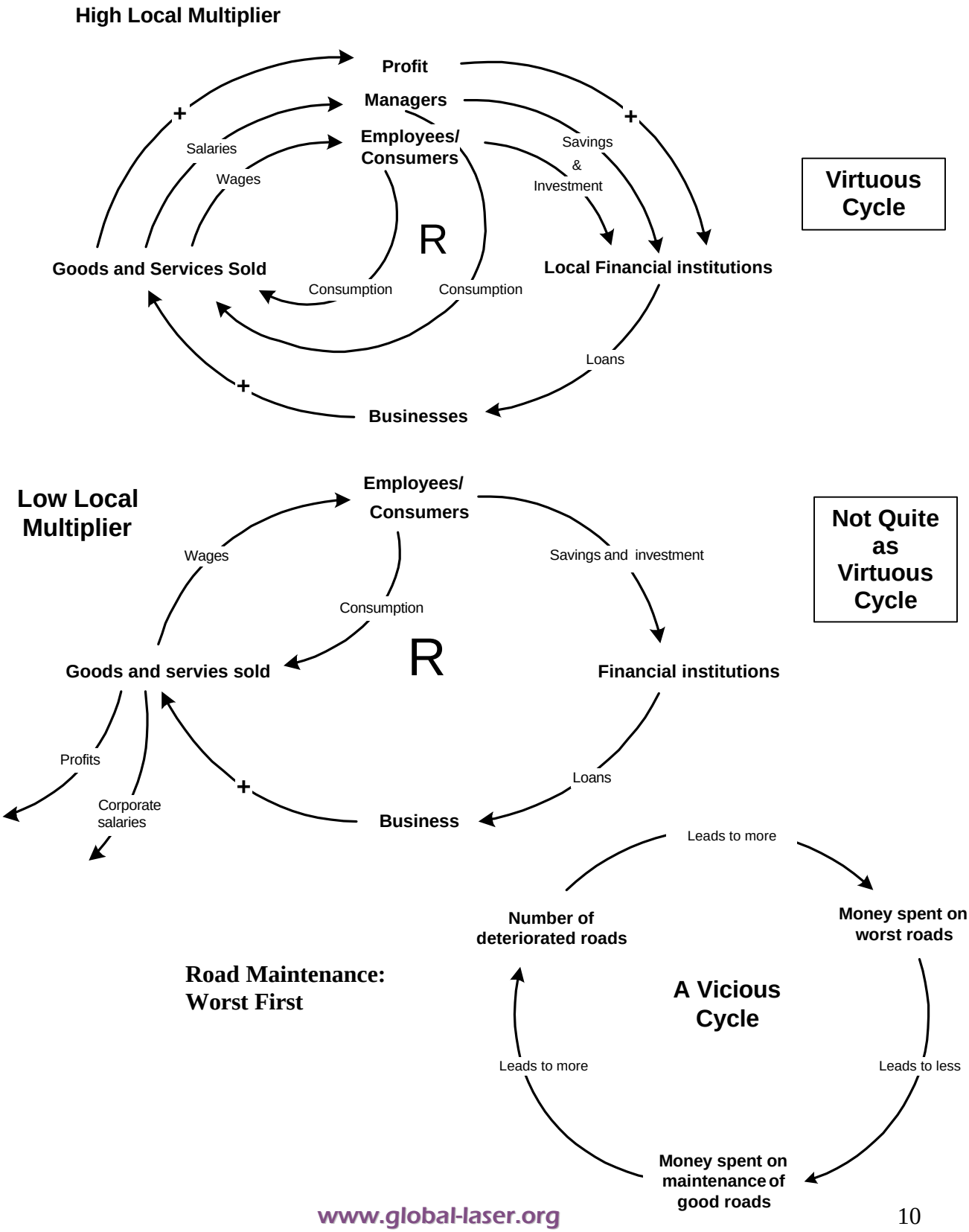




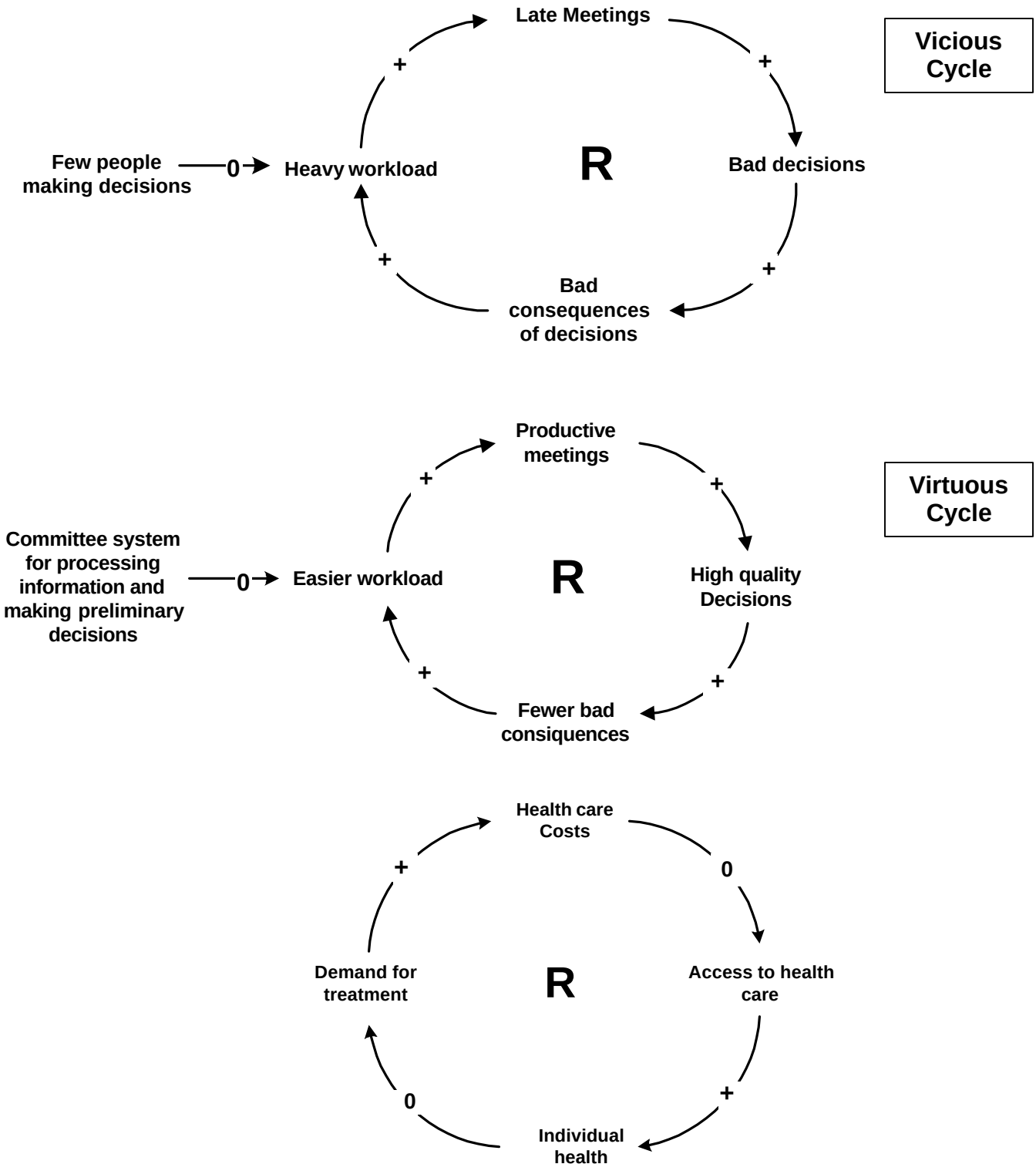
Social Alienation Cycle



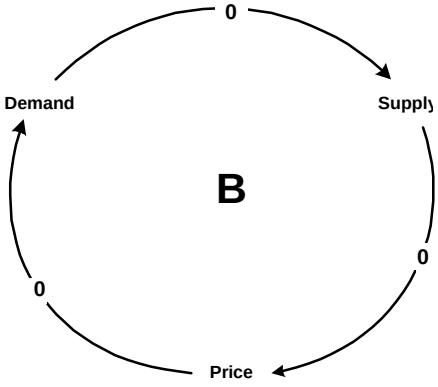
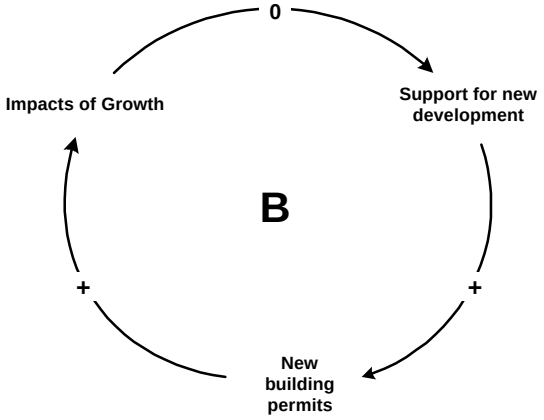
More Reinforcing (Vicious and Virtuous) Cycles: Economy and Built Environment

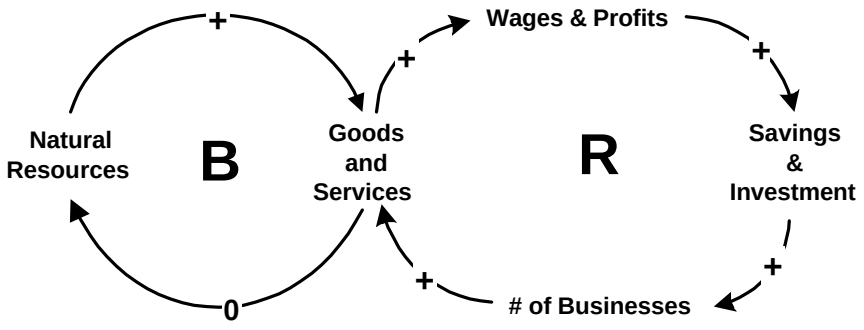
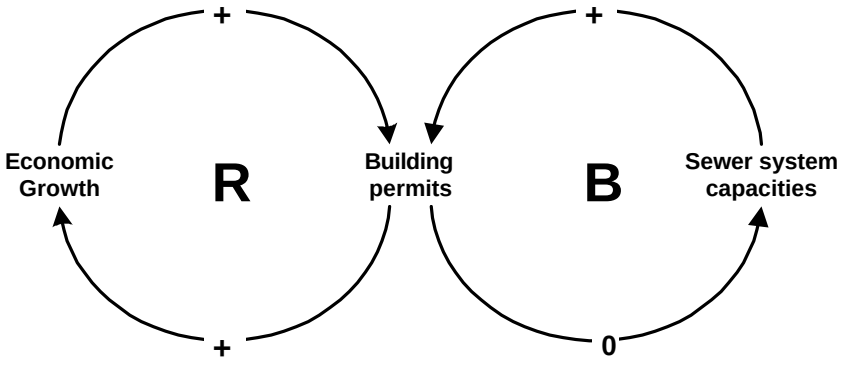


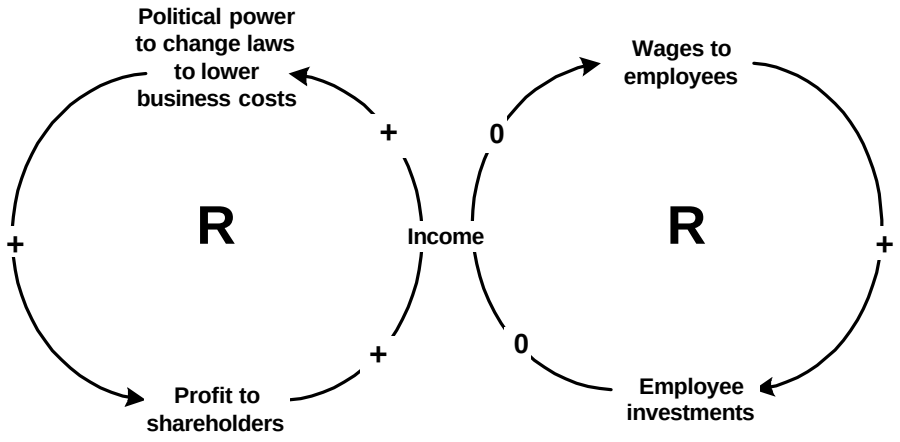
Still More Reinforcing Cycles: Governance and Social Needs

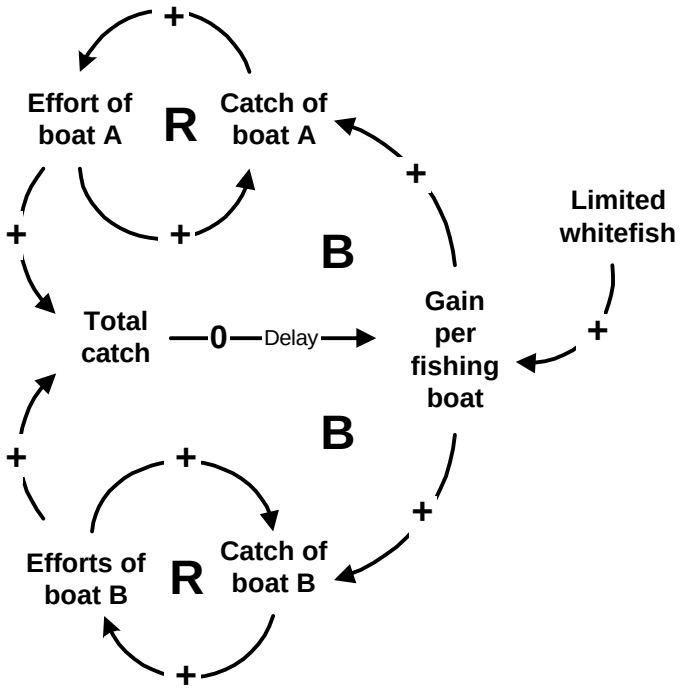


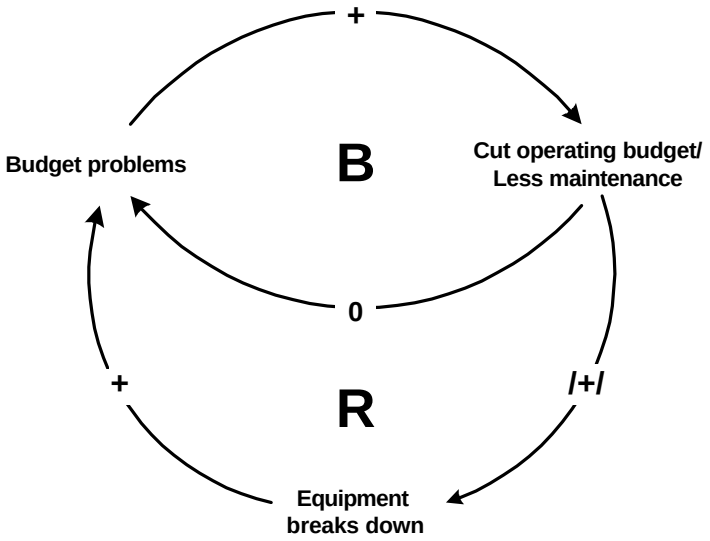
A vicious (or virtuous) cycle in managed health care. It's a vicious cycle now because of the aging population.

	Dynamic Equilibrium
General Description	This system is in balance – the forces that work against action are counterbalanced by forces that work for it. As one thing goes up, the initiative in the system to keep it going up is lowered.
Examples	1. Support for development will tend to be reduced as the impacts of development become more clear, and more harmful. As development slows, however, and the impacts are lowered, support will go up again. 2. Supply and demand in a competitive market exhibit properties of dynamic equilibrium.
Mental Models	1. Not in my backyard (NIMBY). Not in my term of office (NIMTO). 2. Buy low, sell high.
Leverage Points	1. Mitigate the impacts of development as it is initiated. 2. Buy low, sell high.
System Diagrams	 
	Notice how a system can be in equilibrium with either one or three negative feedback loops. The odd number is the key. An even number of negative feedback loops will produce a reinforcing cycle.

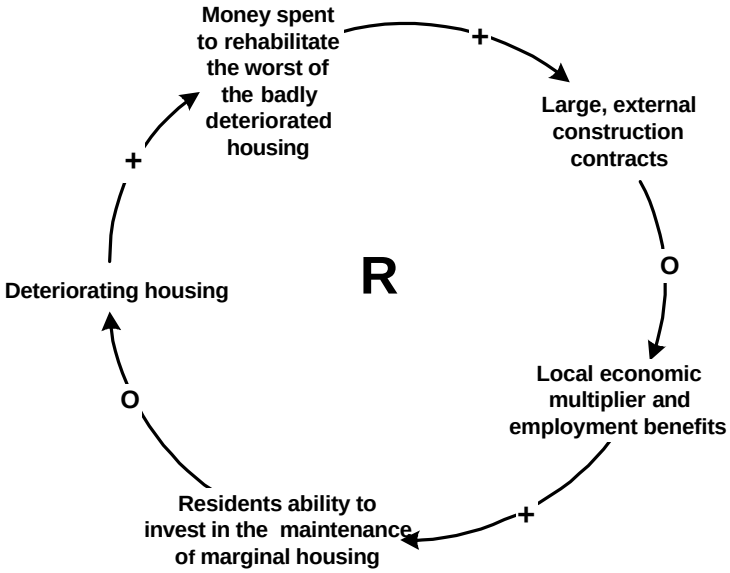
	Limits to Growth
General Description	The growth in an area at first leads to expansion, but when it hits a limit – natural resources run out, staff can't handle more work, etc., then it causes expansion to turn into contraction.
Examples	1. A boom and bust natural resource economy, where growth lasts as long as the resource does, but when it runs out, things crash. 2. The limits of infrastructure within a city system.
Mental Models	1. We're always going to grow, the world is a big place, don't tell me that oil is running out, or that fish catches will decline. 2. New infrastructure is expensive, we hope we'll make what we have last longer than its design life.
Leverage Points	1. Planning for limits that could inhibit success and prosperity by investing in other economic development opportunities when times are good. 2. Capital planning for infrastructure depreciation, so that the money is there to replace aging plants, pipes, sewers, etc.
System Diagrams	1.  2. 

	Success to the Successful
General Description	People are competing for limited resources, and the resources are being allocated to some people instead of others. As the group who gets the resources improves their skill at securing them, they are able to monopolize more and more, while the other group gets less and less.
Example	The increasing gap between the rich and the poor all over the world.
Mental Models	We deserve it. Poor people have always been with us. It's not my problem. People who call for the elimination of poverty are communists, and we know that doesn't work.
Leverage Points	Increasing the equitable share in the creation of wealth, so that employees have an ownership stake in enterprises, recognizing their contribution. Changing the structure of corporate law to insure more democratic control of resources important to continued human survival. In general, plan how to maintain a level of competence in securing resources, and how to influence how resource allocations are made. As a community, explore new ways of making sure that resources are allocated fairly, so that one group doesn't get a disproportional share of benefits at the expense of another.
Systems Diagram	

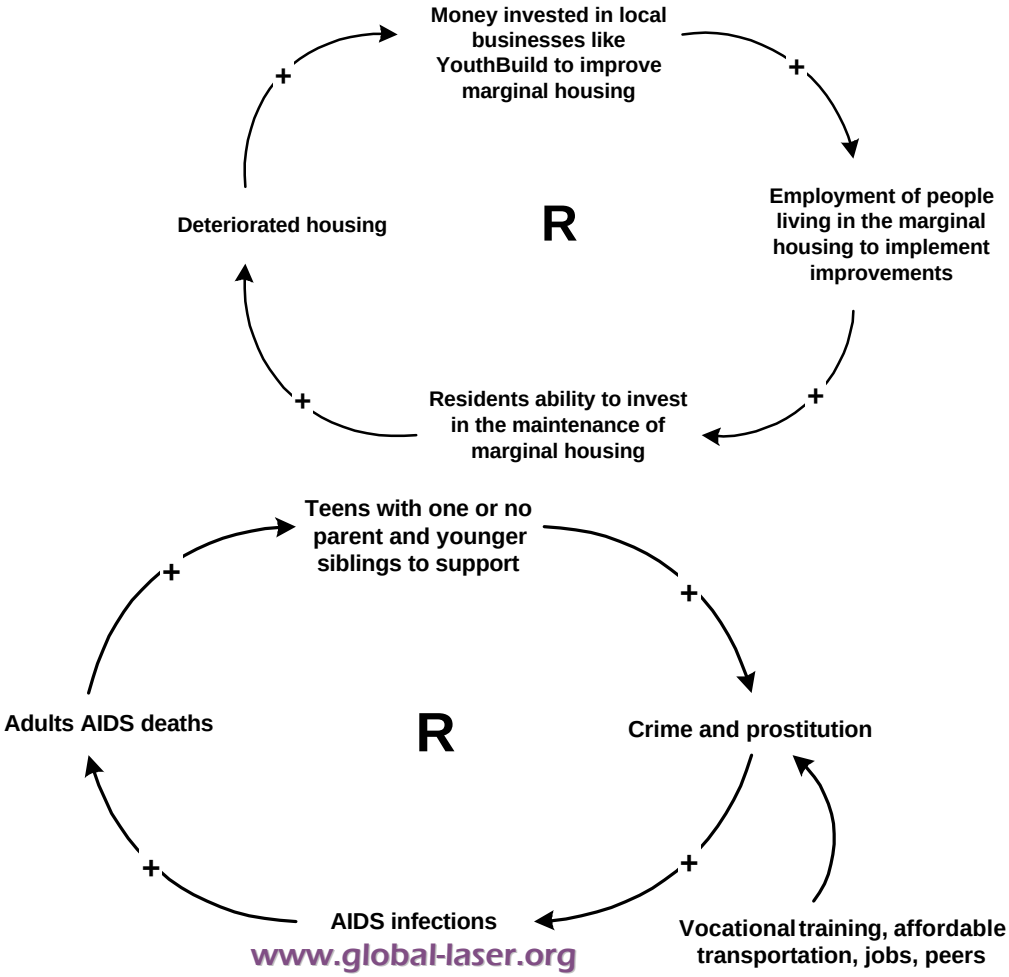
	Tragedy of the Commons
General Description	People or organizations are acting as if they were the sole owners of a common resource, which means that everyone involved in the use of that resource is using it at a level that the resource can't sustain as demand grows. As demand grows, everyone is experiencing decreasing benefits from the use of the resource.
Example	The global collapse of fisheries, where over-fishing was tolerated long after scientists predicted that trouble was coming.
Mental Models	If I don't use the resource, someone else will. There are plenty of fish in the sea. It's a zero sum game.
Leverage Points	Everyone is able to identify the common resource, and recognize the potential for its misuse. Each person acts as if everyone owns the common resource, and participates in decision-making that focuses on the use and distribution of all common resources. The resources are monitored regularly, and the indicators are publicly reported.
System Diagram	

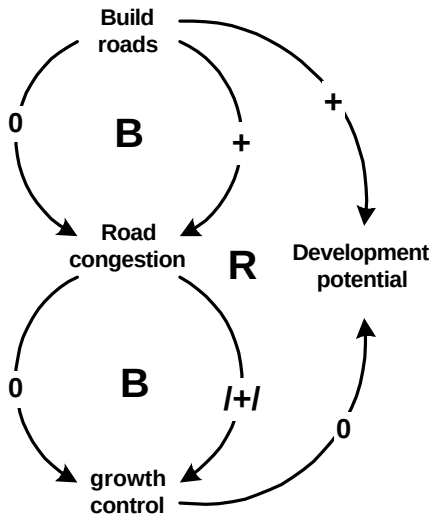
	Fixes that Fail
General Description	The quick, obvious solution to a nagging problem has only made the problem worse over time. This is generally because the quick fix only deals with the symptoms of the problem, not the cause.
Example	City Councils cutting operating budgets to reduce taxes, without taking the full maintenance, upkeep, and depreciation needs of the city infrastructure into account.
Mental Models	Band-aid solutions are usually the right ones. We don't have time or money to understand the roots of the problem. Crisis management.
Leverage Points	Involving as many people as possible in relevant decisions, so that all the implications of the action can be assessed. Stop looking for quick fixes and band-aids for difficult problems. Take the time to understand the whole system, and the roots of the problem before taking action. Measure incremental progress, so you can see things improving, even if it happens slowly.
System Diagrams	

Another Fix that Fails



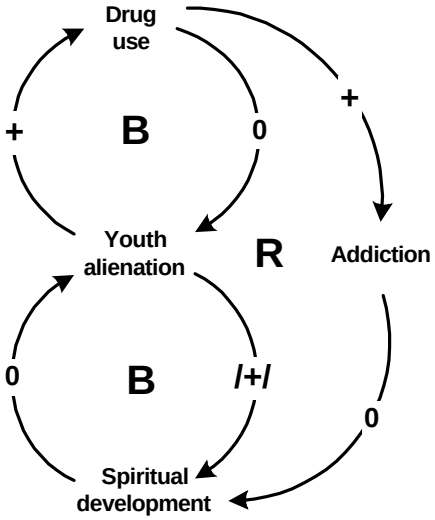
And Some Fixes that Work

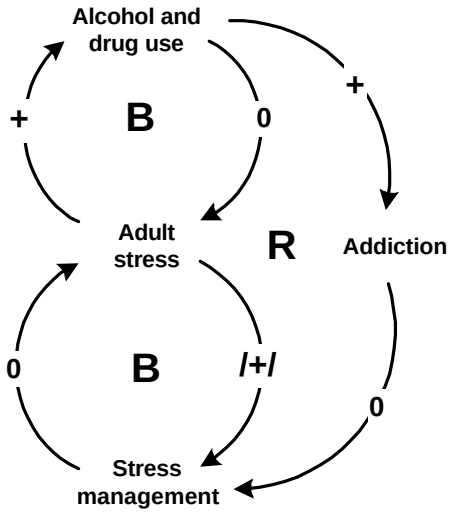


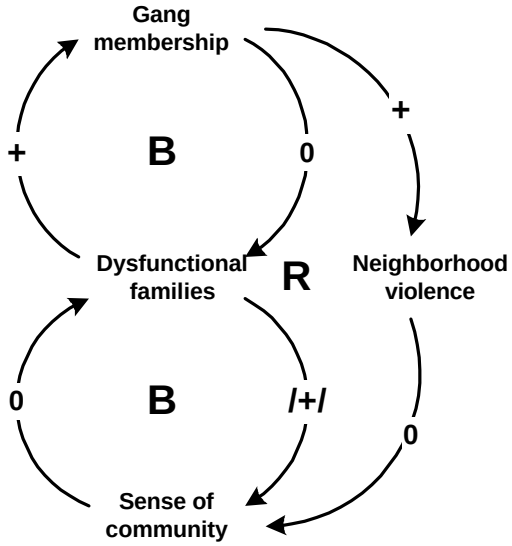
	Shifting the Burden
General Description	This is another case where a quick fix is selected to solve a problem, where the underlying cause is ignored. The quick fix, however, causes unanticipated side effects that over time weaken your ability to address the underlying cause of the problems.
Example	Cities think that building more road infrastructure (new roads, ring roads, traffic lights, widening lanes) will solve the problem of road congestion, when managing growth and sprawl in their region is the root of the problem.
Mental Models	If roads are crowded, we must need better ones. Let's bypass all the city congestion by going around it. Growth is always good. Don't tell me what to do with my land – I want to be able to build suburban homes far from services, jobs, and schools.
Leverage Points	Identifying the underlying cause of problems and being willing to take courageous action to address problems that are getting worse. Trying to avoid band-aid solutions that only address the symptoms, rather than the cause.
System Diagrams	

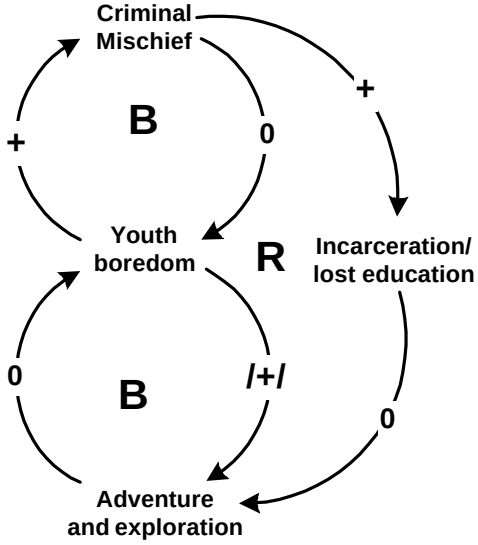
The Shifting the Burden archetype is the archetype of addiction, so it is very common. The quick fix, symptomatic solution for the perceived problem actually undermines the real, long-term solution, which makes the problem worse and increases the desire for the quick fix. There are several more examples on the next page.

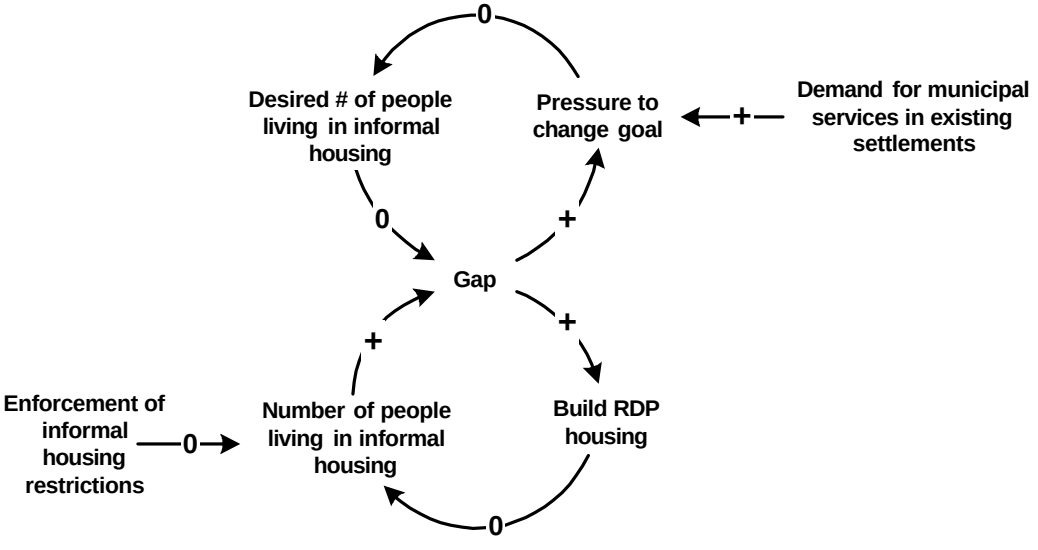
More Shifting the Burden Examples









	Drifting Goals
General Description	The gap between the established goals and actual performance is causing a lot of pressure to adjust the goal downward. Continued poor performance make it impossible to resist the pressure, and strategies begin to be introduced that move you away from the desired target.
Example	Housing construction in South Africa has not kept pace with demand, and so the government does not enforce the ban on new informal settlements, and has to provide services to existing informal settlements, even though their stated goal is to eliminate these substandard settlements and make sure that everyone has decent housing by 2010.
Mental Models	We set the standard too high. We'll always have this problem, there's no way we can really solve it. We'll keep trying, but it doesn't work to raise expectations only to have disappointment.
Leverage Points	Continuous monitoring and evaluation makes you aware of the reasons that performance is not up to expectations, so it's easier to make adjustments before the pressure builds to move away from the goals. Taking consistent action to achieve the goals make it possible to move forward, even when it is a very difficult task.
System Diagrams	

	Accidental Adversaries
General Description	People working in partnership experience increasing levels of conflict as they start to compete with each other. Even if competition was never intended, when the system is structured so that one partner's success can reduce the success of the other partner, increased conflict will occur.
Example	Regional planning in the Calgary area was eliminated several years ago when the increased conflict between the City of Calgary and neighboring communities undermined the regional planning authority. This same risk is present in the current Calgary Regional Partnership structure, if CRP is ever perceived as taking positions that undermine their member municipalities positions. This might be especially true if the municipality that perceives CRP as undermining it is the City of Calgary itself.
Mental Models	It's a zero sum game – their success means failure for us. We can't cooperate in a competitive environment – it weakens our position.
Leverage Points	All parties in the partnership have a high degree of trust that each other's motivations and actions come from the best intentions. There is clarity about the mutual benefits of the partnership, and what the responsibilities of each party are. There is open communication among the partners, and tolerance for mistakes. The parties pay attention to the unintentional side effects of their actions, especially where the partnership or the other party is concerned.
System Diagrams