Chapter 15

The Proper Coupling Package

CURRENTLY THE HUMAN SYSTEM IS IMPROPERLY COUPLED to the larger system it lies within: the environment. The result is the runaway environmental overshoot we see today. It appears possible to engineer *a business model that is so ethically and financially attractive* that its rapid adoption by the global business community would solve the sustainability problem as quickly as is realistically possible.

This chapter presents a theoretical foundation for how this can be done, using an analysis of why the two systems are presently improperly coupled, and a proposal based on that analysis that would result in a highly efficient, self-managing proper coupling of the two systems.

Strategic Overview

The goal of the Proper Coupling Package is to properly couple the human system to the environment, so that the human system acts in an environmentally sustainable manner. The package consists of three solution elements: Environmental Property Rights, Reflective Pricing, and Worldism. Based on the even more fundamental concept of common property rights, an environmental property right is the legal right to own and manage a common environmental "property," such as the percentage of atmospheric CO2 or the health of a river, in much the same way that private property is owned and managed. Reflective Pricing is about the simplest possible implementation of how to manage environmental properties. Worldism is global cooperation on global problems and opportunities, which is necessary to make and enforce the decisions necessary for a uniform global implementation of Environmental Property Rights.

The chief benefit of the Proper Coupling Package is that it is a universal, self-managing approach to all sources of environmental degradation. Once the basic universal legal rights and regulatory bodies are established the solution pretty much runs itself, as opposed to the present day approach where every new environmental problem is solved on a custom basis that inevitably involves haggling, long delays, and imperfection due to compromise and change resistance.

The chief strategy of the package is to design a standard business model that corporations can use over and over to manage the millions of global environmental properties that must be properly controlled if civilization is to achieve global environmental sustainability. The business model is designed to be so ethically and financially attractive that the sustainability sector of the economy will quickly attract the large amounts of top managerial talent and effort needed to move civilization into the Age of Transition to Sustainability.

The Context of the Proper Coupling Package

The Proper Coupling Package is the fourth of five packages engineered in *A Model in* Crisis (a book in progress at Thwink.org) to solve the complete global environmental sustainability problem. It can only be implemented after the change resistance part of the problem is resolved, using the first three packages. However, it appears that if the business model can be designed to be attractive enough, and an incremental startup approach can be taken beginning with receptive regions of the globe, it may be possible to overcome this resistance without resorting to the first three packages. ***This would accelerate the solution by an estimated 10 to 20 years and would be a tremendous breakthrough.***

The work at Thwink.org is driven by the System Improvement Process. This breaks complex social system problems down into three subproblems: how to overcome systemic change resistance, how to move the system from the present state to the goal state (also known as the technical side of the problem or proper coupling), and how to keep the system in the goal state indefinitely. The Proper Coupling Package solves the second of these subproblems.

The System Improvement Process has these steps:

1. **Problem Definition** – What is the problem? This is defined in terms of the goal state versus the present state of the system with the problem. In the goal state the system is environmentally sustainable.
2. **System Understanding** – Why are the three subproblems occurring?
   - 2.1 Why is there such strong resistance to adopting the solution?
   - 2.2 Why is the system not naturally in the goal state?
   - 2.3 Why is the system not staying in the goal state?

3. Solution Convergence – How can the three sub-problems be solved?

3.1 How can adoption resistance to the solution be overcome?
3.2 How can we move the system to the goal state?
3.3 How can we keep the system in the goal state?

4. Implementation – Once a solution is found, this uses three sequential substeps to solve the three sub-problems:

4.1 Overcome resistance to solution adoption.
4.2 Move from the present state to the goal state.
4.3 Stay in the goal state indefinitely.

The first step defines the overall problem. The process then decomposes the overall problem into three sub-problems, and uses main steps 2, 3, and 4 to solve each of them. The Proper Coupling Package is the answer to the question in step 3.2: How can we move the system to the goal state?

It is crucial to understand why the Proper Coupling Package has a high probability of succeeding. It is the output of the process steps that precede step 3.2. Here is a short review of the most relevant steps:

Step 1. Problem Definition – This formally defines the problem using the standard format of "Move system A under constraints B to goal state C by deadline D with confidence level E." The nutshell summary of the problem definition is:

> *The global environmental sustainability problem will be solved when all critical environmental properties are being held in their safe zones indefinitely or are moving there within a predictably safe time span.*

An *environmental property* is a measurable amount of a physical substance in a defined area. Examples are the amount of CO2 in the air, the level of mercury pollution in the Huangou River as it passes through Shanghai, the species extinction rate on the island of Madagascar, or the amount of chromium ore remaining in the earth's crust. A property may be local, regional, or global. A *critical environmental property* is a property that requires active management to stay in its safe zone.

A *safe zone* is the range an environmental property must be in for society's preferred quality of life. Each environmental property has a safe zone. Safe zones are a common concept, as shown on the voltmeter.

By defining the problem in this manner we have avoided the trap of improperly coupling the environmental sustainability problem with other problems, such as poverty or the plight of less developed nations. We have also defined the problem in a manner that will maximize focus of work and problem solving efficiency.

This antique voltmeter has a safe zone of 10.5 to 15.5 volts. Outside that is the danger zone.

In particular, the introduction of the abstractions of environmental properties and safe zones almost magically opens a seldom explored path to solving the problem.

Step 2.1 Why is there such strong resistance to adopting the solution? – This step determined that the prime reason for such strong resistance is the Dueling Loops of the Political Powerplace. The Dueling Loops is an invisible social structure that offers corrupt politicians an inherent structural advantage over virtuous politicians. As a result, corruption, in the form of controlling election outcomes through donations (legal bribes) and in the form of favoritism to pay back those donations, is the norm in politics today, particularly in the United States.

This step also found that *Homo sapiens* is no longer the dominant life form on the planet. That honor now goes to what the analysis calls the New Dominant Life Form, which is the modern corporation and its allies. It appears that the New Dominant Life Form, through the use of massive amounts of lobbying, donations, aggressive think tanks like the Heritage Foundation, and clever manipulation of the media, has figured out how to exploit the power of the race to the bottom of the Dueling Loops. This is true in most industrialized nations, and even more so in the US where the New Dominant Life Form elected a strongly pro-corporate administration in 2000.

Please note this is not an indictment of all corporations and their managers. Most are doing the best they can, and are basically good. Each agent, from its own perspective, is behaving rationally. *It is the life form as a whole that has the emergent property of behaving unsustainably.* This is because the top strategy of for-profit corporations is to maximize the net present value of profits. This results in the New Dominant Life Form promoting behavior that improves short term profits, at the cost of reducing long term profits due to environmental degradation and natural resource depletion.

To summarize, the main reason there has been such strong resistance to solving the global environmental sustainability problem for the last 30 years is the presence of the Dueling Loops of the Political Powerplace, combined with the appearance of the New Dominant Life Form.

Step 2.2 Why is the system not naturally in the goal state? – This a little subtle. On the surface, the answer appears to be what was mentioned above: The system is not naturally in the goal state because the most powerful agent in the human system, the New Dominant Life Form, currently has a very strong incentive to push the system toward the present state, which is unsustainable. But there is a deeper reason, one that provides a powerful clue on where to begin to engineer a solution: The system lacks the proper incentives for the dominant system agent, corporations, to behave sustainably.

Step 1 of the System Improvement Process defined the problem as: *The global environmental sustainability problem will be solved when all critical environmental properties are being held in their safe zones indefinitely or are moving there within a predictably safe time span.* Seen from this point of view, there is a large flaw in the human system that, once corrected, will solve the problem. The flaw is that no fundamental incentive exists for dominant system agents to manage the critical environmental properties properly. In other words, the human system and the environment are presently improperly coupled. Thus the short answer to the question, *Why is the system not naturally in the goal state?* is the lack of a proper coupling mechanism.

Now that we have a clear diagnosis we can move on to designing a treatment that can cure the patient. This is what the next step does.

Step 3.2 How can we move the system to the goal state? – The system of interest is the human system plus the greater system it lies within: the biosphere. The goal state is global environmental sustainability, as measured by all critical environmental properties being in their safe zones or moving there in time. The key to moving to the goal state, once system change resistance is overcome, is resolving the flaw of no proper incentive for the dominant system agent, corporations, to behave sustainability. The Proper Coupling Package resolves this flaw by deep structural change to the human system, in the form of a new universal right just as fundamental as the right to equality, liberty, and fraternity. The new universal right is Environmental Property Rights. Upon this foundation the rest of the package, Reflective Pricing and Worldism, is built.

This explains how the Proper Coupling Package is the output of a formal process. Next let's review the package's foundational concept and its three solution elements. Then we will put them all together into the business model.

The Foundational Concept – Common Property Rights

Environmental Property Rights are a type of common property right. A **property** is some aspect of a system that can be measured. A property may or may not be valuable to people. A property's value can vary over time due to a system's state.

A **common property** is something that a society must hold and manage in common, because the property benefits the group. This differs from the concept of private property, which is not held in common, because private property mainly benefits only its owner or renter.

As a society evolves it gradually improves the rule set it uses to run itself. The more fundamental a particular rule is, the more benefits to society that can be built on that rule. Examples of fundamental rules are the concepts of law, democracy, individual freedom, and private property.

Common property rights are a logical evolutionary progression of private property rights. First a society discovers that private property rights would greatly reduce conflict and greatly increase citizen satisfaction. Then it discovers that there are some types of system properties that fall outside the bounds of private property into common property. Examples of common properties are enforcement of the law, the provision of pubic water and sewage systems, and the construction and maintenance of roads. These are system properties in the sense that each can be measured. For example, enforcement of the law is measured by the percent of laws being enforced. If this is low society suffers.

Once the generalization of common property rights exists, a society can codify it into law in the same manner as other rights. As far as I know no society has done this. Rather than be the first, which could get into scope creep, we will take the smaller and much simpler evolutionary step of starting with just one type of common property right, which becomes the first solution element. But as we do this we must remember that the first solution element's foundation is the concept of common property rights.

Solution Element 1 – Environmental Property Rights

An **environmental property right** is the legal right to own and manage a common environmental "property," such as the percentage of atmospheric CO2 or the health of a river, in return for the responsibility of keeping the property in its safe zone or moving it there in time. By "in time" we mean within a predictably safe time span, such as in 20 years. Note that a common property owner owns the health of the river, not the river itself.

Objective

Recall that the objective of the Proper Coupling Package is to properly couple the human system to the environment, so that the human system acts in an environmentally sustainable manner.

The objective of Environmental Property Rights is to create the new cultural norm necessary to attach the preferred coupling mechanism(s).

Environmental Property Rights are the next evolutionary step after private property rights. Imagine the world before the concept of private property rights ever existed. All property is communal or just there. If you have something in your hand or your hut, it is under your control, but there is no concept of ownership.

Next, imagine the concept of private property rights is invented. People can now "own" property. But there are many ways a society can define the ownership mechanism. In one region it might be on a purely verbal and memory basis. Another might use notched sticks at the chief's lodge to keep track of who owns what. Another might set up a code of law to define the whole thing. And so on. The point is that a wide variety of mechanisms can be used to implement the concept of private property rights.

In a similar manner Environmental Property Rights introduces a new concept to the modern world. Exactly how it will be implemented can vary, and probably will as time goes by. One way to implement this new right is Reflective Pricing, which is covered later in this paper.

Rationale

Without Environmental Property Rights everybody's business is nobody's business, because there is no one with the incentive to wisely manage and protect the millions of "global commons" environmental properties.

Property rights have long applied to land, buildings, farm animals, and all sorts of objects. Property rights have proven to be a fundamental prerequisite to modern civilization. By extending the notion of property rights to environmental properties, a long standing flaw in the human system is finally corrected with a minimum amount of effort and complexity. It's a simple, scalable, elegant solution to a very complex problem. Decades from now we may consider Environmental Property Rights just as historically fundamental as the right to vote and numerous other foundational human rights.

The elegance of Environmental Property Rights is that once the concept is added to the human system, it is much easier to activate new environmental properties as they become necessary. Contrast this to the present, where each newly discovered problem becomes a bruising battle handled on a case by case basis. The battle is too often lost. It is also too often handled differently from country to country, making it more difficult to resolve the problem globally.

Description

Environmental Property Rights would include these key aspects: (Please remember this is a very tentative first pass.)

1. **Claims** – Anyone may file a claim on an unclaimed environmental property. All they have to do is show that presently the property is unmanaged, that managing it will benefit humanity, and how they would manage it wisely. This is similar to the way settlers filed claims on a piece of public land they wished to own, or the way miners file mining claims. The notion of claims allows new environmental problems to be automatically solved by market forces, which will greatly accelerate solving the complete environmental sustainability problem. A self-managing free market approach is much more efficient than a regulatory approach or a command and control economy, because these two alternatives lack the proper feedback loops to be highly efficient.
2. **Income** – The owner of an environmental property may charge users of that property a **fee** for the privilege of "using up" that property. This would allow the owner to adjust the fees to the level needed for sustainable use of the property, in the same manner that Adam Smith's invisible hand automatically regulates supply and demand by the setting of prices. Fee income may be used for any purpose desired, as long as it relates to solving the global environmental sustainability problem and gives priority to the property the fees came from. Fees must be charged in a uniform manner to all users.
3. **Reward for wise stewardship** – The regulatory body administering Environmental Property Rights will reward property owners for wise stewardship. The reward is the amount of the income a property owner may keep as net profit. The reward curve will

be calculated in such a manner as to greatly reward helping to move civilization to sustainability in time and keep it there. The reward curve will be published and predictably stable. The better a property is managed the higher the reward.

4. **Accountability** – All environmental property owners are responsible for moving their property to the safe zone as fast as is reasonably possible and keeping it there indefinitely. Those failing to do this will lose their claim, and the property will revert back to being an unclaimed environmental property.

Solution Element 2 – Reflective Pricing

Reflective Pricing is a free market mechanism causing the transaction price of everything to reflect the best interests of the buyer, the seller, and the environment. It requires Environmental Property Rights.

Objective

The objective of Reflective Pricing is to implement the concept of Environmental Property Rights in a reasonably efficient and effective manner. This is done by providing the actual coupling mechanism between the human system and the environment. In the jargon of economists, Reflective Pricing serves to internalize what are now externalized costs.

Overview

Reflective Pricing adds "fees" to the price of any unsustainable behavior. The more unsustainable it is, the higher the fee. This causes more sustainable practices to be substituted for unsustainable ones. Over time the human system gradually becomes more and more environmentally sustainable, until eventually it is 100% sustainable.

The fees must be large to have an effective impact, so they must be particularly large on practices that seem "necessary." This will generate huge amounts of income. Rather than use that income for something else, such as income tax reduction or wealth redistribution, it is used for administrative expenses and "buys." A **buy** is a payment from a property manager to buy a human activity that benefits the property or some other aspect of the sustainability problem. Examples are technology development, educational programs, assistance programs to adopt more sustainable practices, and transfer of knowledge to low income areas of the world.

Each environmental property has a **safe zone** the property must stay in or be moving towards in time. The further a property is from the safe zone, the higher the fees, and so the more money available for buys. Fees push properties towards the safe zone. Buys pull it there. These two forces create an extremely efficient set of feedback loops working together to cause the price of everything to now not only reflect the interests of the buyer and seller, but also the environment. Adam Smith's invisible hand now reaches where it should.

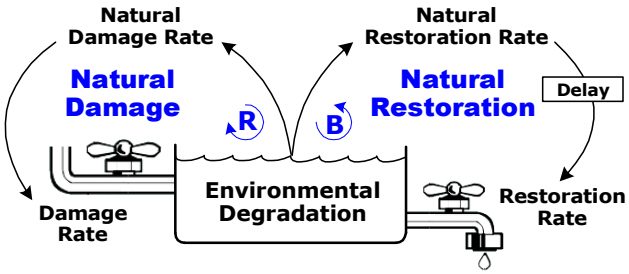
Because the money available for buys will be so large, buys will have a sizable affect on the human system. If they are used on high leverage areas they can have much more of an impact than fees. Buys essentially amplify the power of fees.

For example, fees that raise the price of gasoline tend to have little effect on consumption until they grow quite large. But a modest fee of say, .10 euros a gallon, would raise about 50 billion euros a year worldwide. [119] If 20% of that (10 billion euros a year) was invested in just one type of buy, development of ways to reduce greenhouse gas emissions from the burning of fossil fuels, and the results were given free of charge to anyone to use, the effect on greenhouse gas emissions would be stunning. But we can do better than that. If another 20% of the buys went to research on ways to reduce deforestation, and the results of that were also given away, the results would be even more impressive. Finally, if 40% of the buys went to implementing the results of the research on ways to reduce greenhouse gas emissions and deforestation, the climate change problem would be well on the road to being solved. And all for a mere .10 euros a gallon.

It is essential to not use the income from fees for anything other than improving environmental sustainability, because that would introduce new feedback loops that would greatly distort system behavior. For example, using fees to reduce personal and corporate income tax would give people and corporations the perverse incentive to NOT solve the sustainability problem, because solving it would raise their income tax!

Next let's examine the reasoning behind the design of Reflective Pricing.

The state of the environment while *Homo sapiens* was still a hunter/gatherer



Rationale

To fully understanding why Reflective Pricing is designed the way it is, let's examine a series of causal flow diagrams. We will start with a small one and add more loops until we have the complete diagram.

The diagram above models the state of the environmental while *Homo sapiens* was still only a hunter/gatherer. This mode of existence was permanently environmentally sustainable.

Think of Environmental Degradation as a gigantic bathtub. The fuller it is, the worse the degradation. The bathtub fills up due to the damage rate and empties due to the restoration rate. The natural damage rate is equal to the natural restoration rate, causing the level of Environmental Degradation to stay at a low, normal level. If the natural damage rate increases, such as when a volcano erupts or a hurricane hits, the natural restoration rate goes up to accommodate it, until the level of Environmental Degradation returns to normal.

While the human system was still primarily one of living off the land without disturbing it, the human system had no significant effect on the damage rate. For example, the Australian aborigines established a hunter/gatherer society that was sustainable for 40,000 years on an entire continent.

But starting around 10,000 years ago, some groups of *Homo sapiens* broke that pattern with the invention of agriculture. Later the inventions leading up to the Industrial Revolution broke it still more, tipping the human system into a grossly unsustainable relationship with the biosphere, as shown on the next page.

That subsystem is the basic problem to be solved, in terms of symptoms and direct causes. Direct causes are also known as proximate, immediate, or superficial causes. The diagram aggregates all undesirable environmental symptoms into Environmental Degradation. This consists of three types of degradation: pollution, depletion of renewable natural resources, and depletion of non-renewable resources. Examples of each of these are global warming due to greenhouse gases pollution, the depletion of fish stocks and deforestation, and the depletion of concentrated minerals such as oil, chromium, and copper.

Before the environmental sustainability problem occurred, the damage rate and the restoration rate were equal, and the level of degradation was low. But today we have a different story. The damage rate exceeds the restoration rate by such a serious amount that the bathtub is filling up. When it starts to "overflow," catastrophes such as local famines and local epidemics will begin. This will later be followed by global population and economic collapse. Thus we have a serious problem that must be solved proactively on a system wide basis.

The subsystem contains four feedback loops. The upper two are natural, while the lower two are man-made.

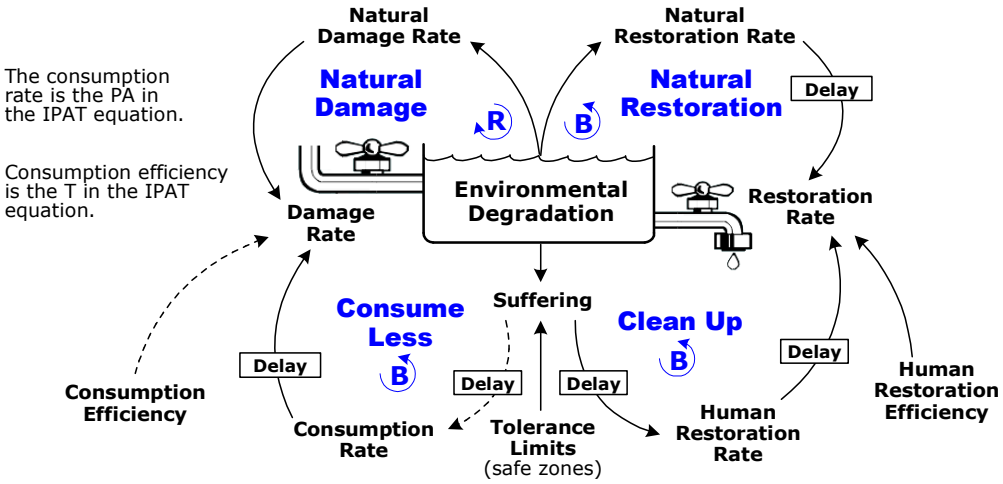
The **Natural Damage** loop is normally very minor. Suppose lightning causes a forest fire. This increases the damage rate, which increases Environmental Degradation. This in turn increases the natural damage rate the next time it rains, because the forest floor is more susceptible to erosion. As the natural damage rate goes up, so does the total damage rate, and the loop starts all over again.

Because growth in one node causes growth in the **Natural Damage** loop as it goes round and round, it is a **reinforcing feedback loop**. Reinforcing loops can grow indefinitely, until one or more balancing loops stop them. A **balancing feedback loop** exists when change in one node is balanced by forces in that loop that serve to reverse that change. All real world dynamic systems consist of at least one reinforcing loop and at least one balancing loop.

Opposing the reinforcing loop of **Natural Damage** is the balancing loop of **Natural Restoration**. This loop allows nature to restore the system to its normal state of very little degradation. As Environmental Degradation rises slightly, so does the natural restoration rate. After a short or long *delay* of the time it takes to restore degradation, such as the way a forest can recover

The Direct Causes of Environmental Degradation

This is the basic problem to be solved



from a fire (a long delay) or the way plants can remove CO2 from the air as part of the carbon cycle (a short delay if there are enough plants), the total restoration rate increases. This serves to reduce the amount of Environmental degradation. This in turn decreases the natural restoration rate, which cause the loop to decrease in strength, so that the loop does not overshoot. Instead, it eases the system back to its normal state of very little degradation.

The **Consume Less** loop is a balancing loop. As the consumption rate increases, so does the total damage rate. This causes Environmental Degradation to increase, which causes suffering to increase due to more disease, less food, more conflict over fewer natural resources, and so forth. After a *delay* of how long it takes people to react to increased suffering that exceeds tolerance limits by dying or deciding to consume less so as to reduce their own suffering, the consumption rate decreases. (The dashed arrow indicates an inverse relationship.) In this manner the loop serves to balance the health of the system by reducing excess consumption. This is the loop that civilization is "up against" as it confronts the global environmental sustainability problem. If the problem is not solved proactively, this loop will force society to reduce its consumption rate by way of population and economic collapse.

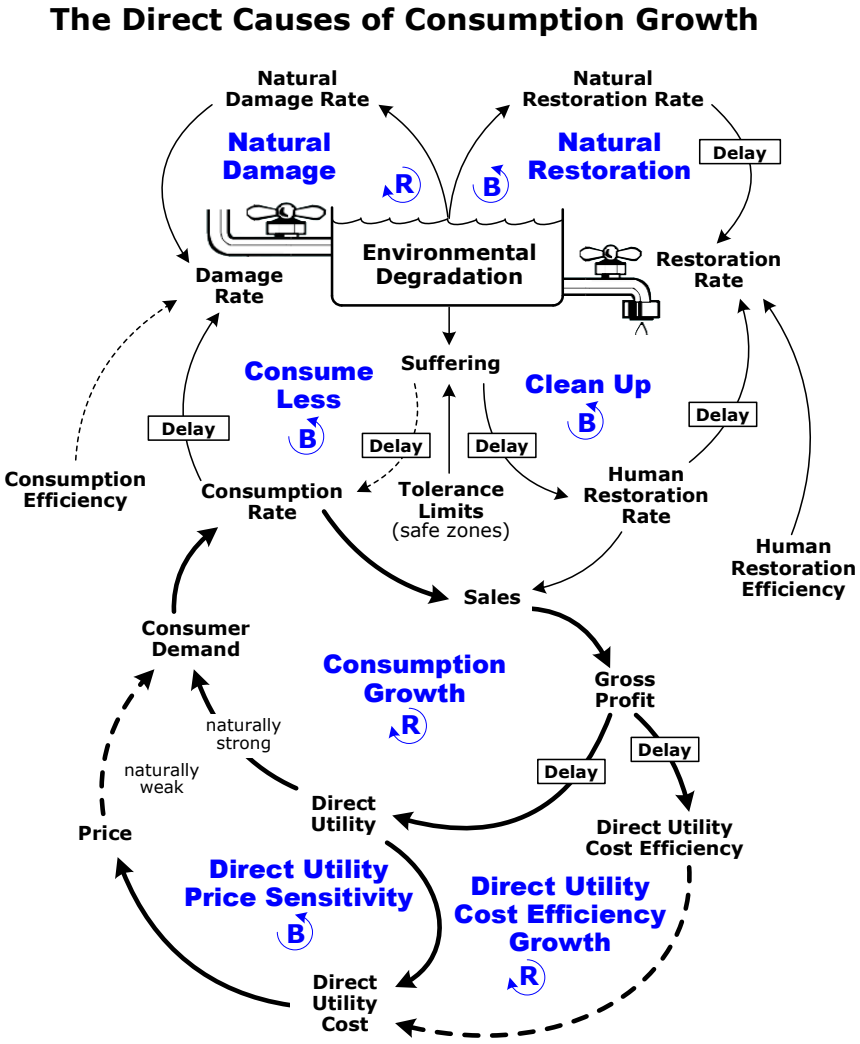
One response from the human system has been the **Clean Up** loop. As intolerable suffering increases, once people figure out how to clean up the human restoration rate increases. This increases the total restoration rate, which decreases Environmental Degradation. For example, after an oil spill people clean it up, or after soil nutrient depletion due to poor agricultural practices, farmers may restore the nutrients by spreading compost over their fields or planting nitrogen fixing crops. But the drawback to relying on the **Clean Up** loop to solve the sustainability problem is that cleanup is prohibitively expensive for most types of large degradation, such as the 760 billion tons of excess CO2 currently in the atmosphere. [120]

The damage rate equals the natural damage rate plus the human consumption rate times one minus consumption efficiency. Efficiency is how much an activity helps *Homo sapiens* without harming the environment. It varies from 0% to 100%. If it's low then the damage rate will be high. For example, a low efficiency approach to topsoil retention in agriculture will cause consumption of food to cause a high damage rate on the system's topsoil. On the right side of the diagram, the restoration rate equals the natural restoration rate plus human restoration efficiency times the human restoration rate.

Because **Clean Up** is prohibitively expensive on anything but small degradation problems, the solution to the sustainability problem can only come from improving two nodes on the diagram: consumption efficiency and the consumption rate. So let's expand the diagram to see what is presently causing the consumption rate to be too high. The expanded diagram is shown on the next page. Later we will expand it still further to see what is causing consumption efficiency to be too low.

The lower portion of the diagram is intuitively understood by sharp managers. But unless we formalize it into a diagram, it will be impossible to later show how efficiently Reflective Pricing attaches to the human system.

The expanded diagram adds three loops. These are the loops that, more than anything else in the system, are driving the entire course of modern civilization. Most of the effects of these loops are beneficial, but some so called side effects, such as an increase in the damage rate, are not. Let's begin by taking a look at how the **Consumption Growth** loop operates, and then how it works with the other two added loops.



As the consumption rate goes up, so does sales. This increases gross profit. After a *delay* due to the time it takes to invest these profits, direct utility goes up. **Utility**, also known as quality or value, is the benefits a product gives a consumer. **Direct utility** is the direct benefits a product gives the consumer, such as the way modern antibiotics greatly extend the average lifespan. As direct utility increases so does consumer demand, which in turn causes the consumption rate to increase even more, and the loops starts all over again.

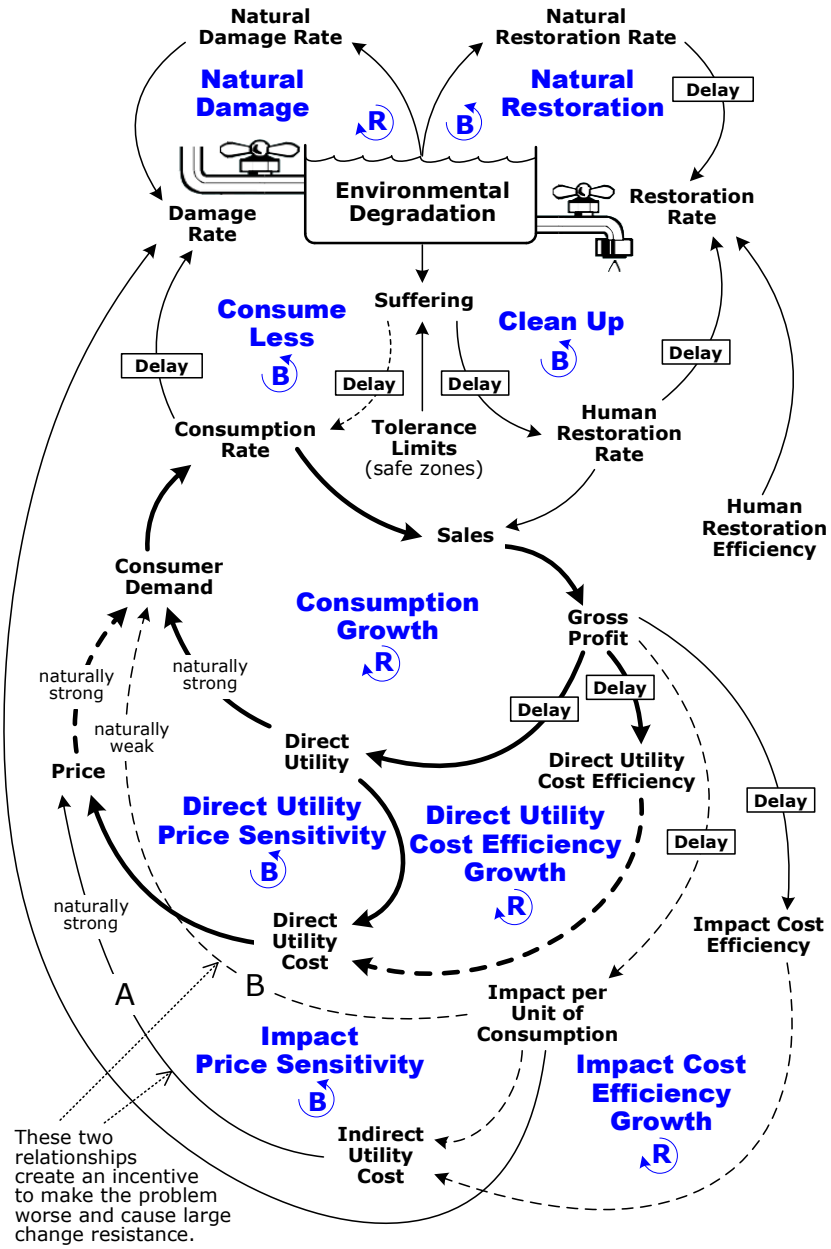
Next let's examine the **Direct Utility Price Sensitivity** loop. Direct utility (direct benefits) is not a free lunch. For example, the first generation of computers cost millions of dollars and took up a room the size of a football field, because they were based on vacuum tubes and generated huge amounts of heat. They were so expensive to produce that manufacturing costs were sky high. These costs are shown on the diagram as direct utility cost. Thus as direct utility increases, so does direct utility cost. This causes higher prices, which in turn decreases consumer demand. Thus this loop serves as a balancing loop to the **Consumption Growth** loop, and keeps it from growing to infinite amounts.

But gross profit can be invested in more than just increasing direct utility. It can also be invested in ways to cut manufacturing costs, which is called direct utility cost efficiency. An increase in this causes a decrease in direct utility cost, which reduces the price, which increases consumer demand. Thus the **Direct Utility Cost Efficiency Growth** loop can drive consumption to very high levels, causing the system to slip into overshoot mode. This is exactly what has occurred. Today civilization is overshooting its global environmental carrying capacity by about 25%. [121]

Once a society overshoots its environmental limits, the main limit to consumption growth is the **Consume Less** loop. In overshoot mode a society sees its consumption rate reduced due to an increase in suffering, which includes death and lower standards of living due to disease and natural resource shortages. Death reduces demand due to less population. A lower standard of living reduces demand due to less consumption per person. Thus in this simplified model suffering is due to health or economic causes. The above diagram explains the basic structure causing economic growth and how that in turn causes Environmental Degradation.

But why is a species as smart as *Homo sapiens* committing ecocide on such a colossal global scale? If we could find the answer to that question, we could begin to understand the system well enough to determine how to engineer a solution to the problem that would actually work. So let's extend the diagram again by adding two more loops that should shed some light on this intriguing mystery. The revised diagram is shown to the right.

Why is Homo Sapiens Committing Global Ecocide?



The two new loops model what economists call external costs. Long the bane of economics, an **external cost** is a cost that is so external to a transaction that it is not included in the producer's costs, and so is not included in the price. For example, tomorrow's cost of cleaning up all sorts of pollution is not included in today's prices for the products causing that pollution. External costs are also called detrimental side effects.

The two new loops work in a similar manner to the two lower loops of the previous diagram. These loops deal with how efficiently society consumes environmental inputs. The lower the efficiency the greater environmental damage is, as shown by the far left dashed arrow. Dashed arrows are an inverse relationship, so as impact per unit of consumption goes up, the damage rate goes down.

Let's study the lower left loop first. Once a producer or society sees suffering reach intolerable levels, it starts to make serious investments in lowering impact per unit of consumption (the T in the IPAT equation) in order to reduce the damage rate. But as the **Impact Price Sensitivity** loop shows, as T goes down indirect utility cost goes up, which increases the price, which reduces consumer demand because consumers are very sensitive to price. Producers do not like to see their sales fall, so they resist investing to lower impact per unit of consumption. This leads to environmentally unsustainable behavior.

The key insight in this diagram is the **Impact Price Sensitivity** loop introduces relationships A and B. These create a strong incentive to make the problem worse, because B is naturally weak while A is naturally strong. It takes money to reduce impact per unit of consumption. Most consumers don't care about impact (B) nearly as much as they care about price (A). Since A is much stronger than B, A usually wins and consumer demand goes down. *This is the precise reason why producers tend toward unsustainable behavior and resist investing to be more sustainable.*

Now suppose producers feel they must reduce impact per unit of consumption, such as due to new laws or a consumer sustainability awareness campaign. They know this will cause a drop in demand because price will go up. To reduce that problem they will also invest in reducing impact cost efficiency. As the **Impact Cost Efficiency Growth** loop shows, an increase in impact cost efficiency will lower indirect utility cost, which will lower the price, which will increase consumer demand. However, this increase in demand is usually not enough to compensate for the drop in demand caused by invest-

ing in impact per unit of consumption. For producers to be more sustainable, their cost of production must go up, causing profits to go down. That's the immediate cause of change resistance.

It's true that some sustainability practices result in cost savings. But these are the low hanging fruit. Most of this was picked long ago. On the average being more sustainable drives up costs and thus prices.

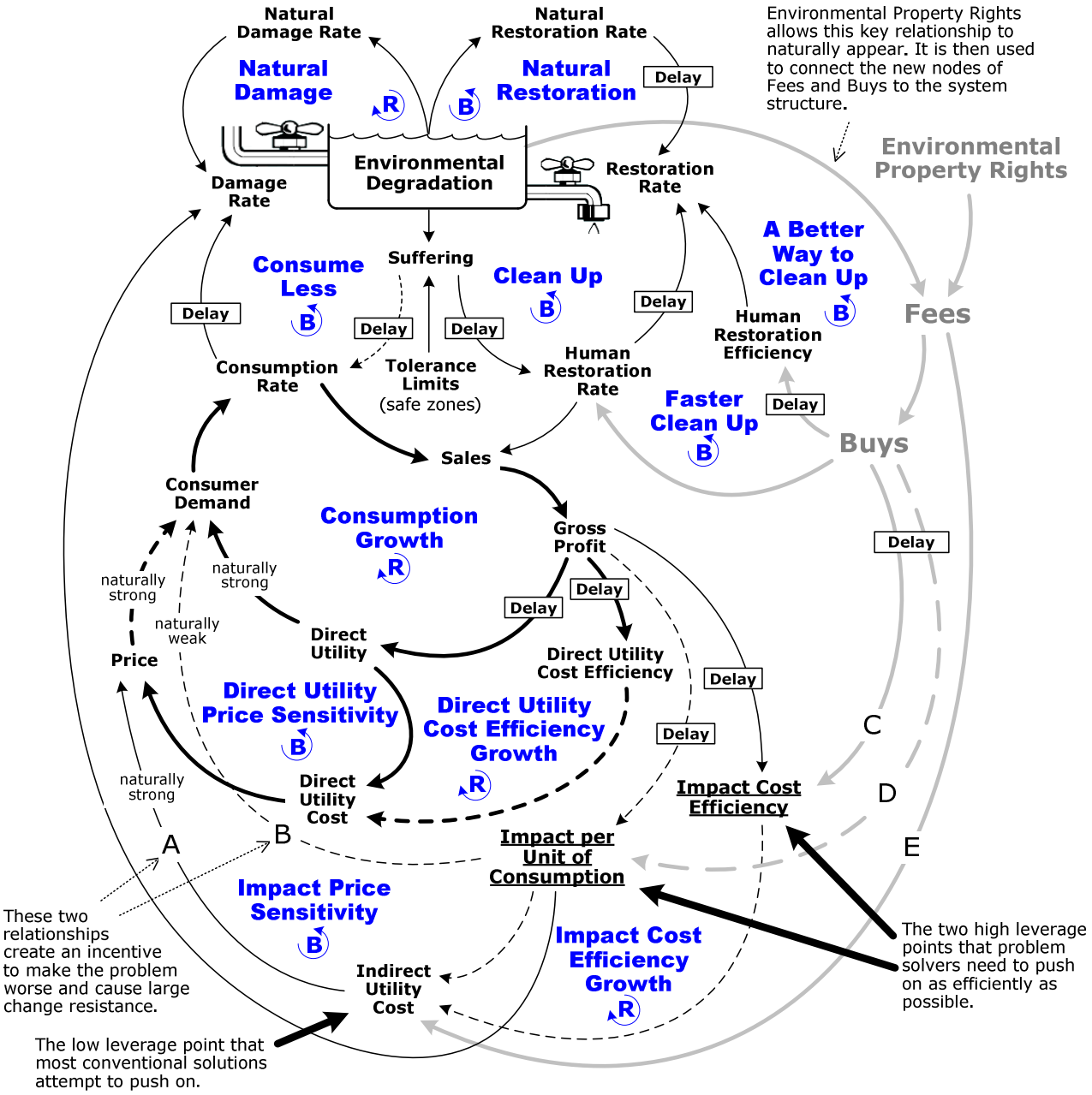
To summarize, the lesson of the two lower loops is they clearly show why *Homo sapiens* is committing global ecocide. Relationships A and B combine to create a tremendous incentive for the dominant agents in the human system, large for-profit corporations, to behave unsustainably. Those that don't play the game that way will be wiped out by those that do, due to the iron law of survival of the fittest. The result is the system becomes populated by dominant agents who strongly prefer unsustainable behavior. This is why change resistance is so strong.

Unless deep structural changes are made to the system that somehow overcome these two relationships by properly coupling the human system to the environment, the system will continue to drag civilization closer and closer to the abyss of environmental catastrophe. We now turn our attention to how this can be done, as shown in the complete diagram on the next page.

The proposed solution stands a high probability of working because if our analysis is correct the solution pushes on the right high leverage points in the simplest, most efficient manner possible. The high leverage points are impact per unit of consumption and impact cost efficiency.

Contrary to popular belief, indirect utility cost is not a high leverage point. It is an intuitively attractive low leverage point *if you only push there*. The conventional solutions of tradable permits, pollution taxes, and so forth that push there must be huge to have their intended effect. Anything that large is seen as an unnecessary cost by the dominant agent in the system, corporations, and so is resisted fiercely and successfully.

Proper Coupling of the Human System to the Environment



The completed diagram works its magic by adding a mere three nodes: environmental property rights, fees, and buys. First the concept of common property rights causes the legal creation of environmental property rights to occur. This in turn allows the fees node to be added. Then Reflective Pricing goes one step further by adding the buys node. This causes the human and environment system to become properly coupled. Starting at the top, here's how the proper coupling mechanism works:

Claims may be filed on any unclaimed environmental properties causing Environmental Degradation. Once a claim is approved, the existence of environmental property rights and the presence of environmental degradation combine to allow an environmental property owner/manager to start charging fees. Following relationship E, fees increase indirect utility costs, and by way of relationship A, fees lead to increasing the price of products. This reduces consumer demand, and hence also the consumption rate and the damage rate, which solves the problem.

But there's more to how fees affect system response. As we explained before, as soon as producers see the consumption rate start to fall, they take action, so as to minimize the drop in sales and gross profit. They redirect investment of gross profit to impact per unit of consumption and impact cost efficiency, such as by R&D on ways to more completely recycle their product

or have its production produce less pollution. If they raise impact cost efficiency enough then indirect utility cost will drop, which ultimately causes their gross profit to go back up. Note that it will not go as high as it was before, due to diminishing returns. For most situations greater impact cost efficiency cannot reduce additional indirect utility cost to zero, especially once the low hanging fruit has been picked.

The great drawback to using fees alone is that for most products it will take a very large price increase to reduce consumer demand enough. For example, from 2000 to 2008 the price of gasoline in the US more than doubled. This had little effect on reducing demand, however. It would take at least another doubling to have a significant effect and probably an increase by a factor of 10 or more to reduce the consumption of gasoline to sustainable levels. But this would have a devastating impact on the economy, causing overall production to fall by 50% or more if introduced suddenly. But we must reduce fossil fuel burning to very low levels quickly if we are to solve the climate change problem in time. So what can we do?

This is where buys come in. About 90% of fees are used for buys. A buy is a payment from a property manager to buy a human activity that benefits the property, such as paying a firm to research ways to produce a product with less raw materials and pollution. Environmental property owners pool their buys to do this, which greats great economies of scale. The benefits of this go back to the very same producers who paid the fees. *This circular path is why Reflective Pricing is so efficient.*

Buys are purchases that directly increase impact cost efficiency or lower impact per unit of consumption, which are relationships C and D. Because buys do this directly, rather than the long tortuous route that fees alone must take through the system to increase them indirectly by much smaller amounts, fees and buys are much more efficient than fees alone in solving the problem. This is why the high leverage points are consumption efficiency and consumption efficiency cost, not indirect utility cost.

Buys can also be used to strengthen the **Clean Up** loop. The diagram shows how they can be used to buy cleanup work directly, which increases the human restoration rate through the **Faster Clean Up** loop. They can also be used to improve cleanup indirectly, by buying R&D that would increase human restoration efficiency, which is a **Better Way to Clean Up**. But we must not expect the **Clean Up** loop to help much at all, because restoration is so much more expensive than avoidance of damage in the first place. From a quality control perspective, we must engage in defect prevention instead of defect removal.

This completes the rationale behind the design of Reflective Pricing. Next let's see how it would work.

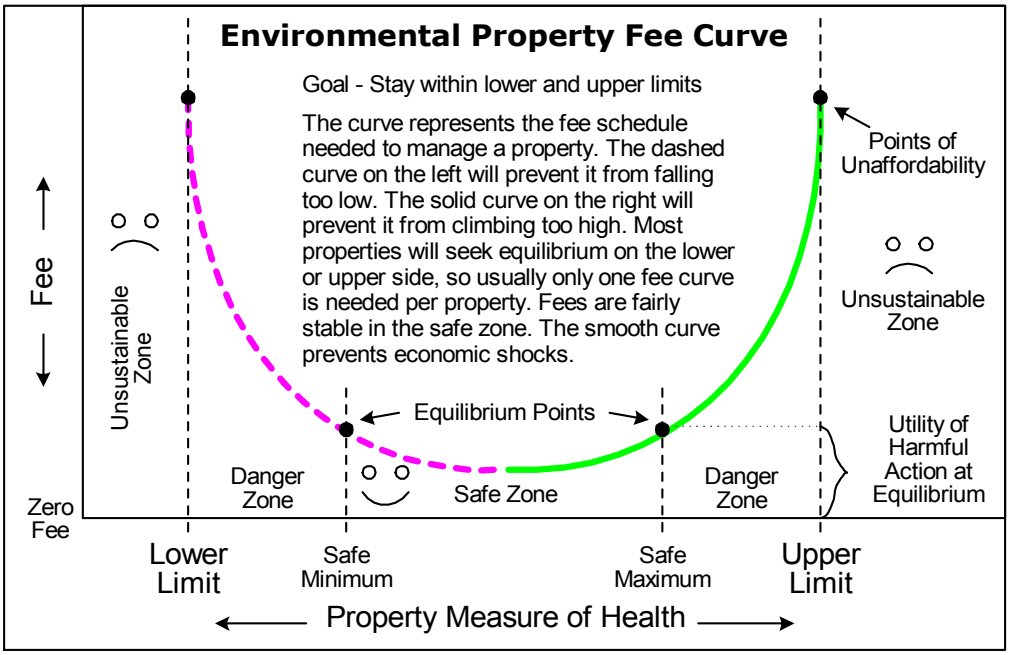
Description

An environmental property is some characteristic of the environment that is of a global, regional, or local commons nature. Examples are percent of atmospheric CO2, river water quality, habitat quality, and percentage of remaining renewable and non-renewable resources. A safe zone is where the property must be for it to be in a healthy state. For example, the safe zone for CO2 might be between 280 and 320 parts per million (ppm). If CO2 and other greenhouse gases stayed in their safe zones then the effects of global warming would be acceptably small. Currently CO2 is at about 379 ppm and rising. Before the Industrial Revolution it had never gone above 300 ppm in the last 600,000 years. [122]

Environmental property owners would have the right to charge fees to any agent causing their property to move out of the safe zone or not be moving there in time. This is the equivalent of property rent or mineral extraction fees.

Currently prices rarely reflect full environmental impact. This causes economic behavior to have the unwanted side effect of environmental unsustainability. Although this behavior is irrational in the long term, in the short term it is entirely rational. All solutions that do not make environmentally unsustainable behavior economically irrational in the short term are doomed to failure, because modern civilization is totally driven by short term economic self-interest.

Reflective Pricing implements the concept of Environmental Property Rights. It is not meant to be *the* solution, just an example of a reasonable one. Reflective pricing only solves the technical side of the problem. The much more difficult social aspects of solution adoption resistance, solution circumvention, quality of solution management, and so forth must still be solved. Very briefly, here's how Reflective Pricing works to make human behavior environmentally sustainable:



✓ **1. Establish environmental property rights** – Each environmental property of concern, such as atmospheric CO2, tropical forest coverage, nickel reserves, New England codfish, and ocean mercury pollution, is identified by a regulatory body or through claims. The right to manage each property or group of properties is contracted to a property manager, who may be public or private. Sovereign state and enforcement issues are resolved, probably through an international organization. *This forms the legal and international foundation for reflective pricing.*

✓ **2. Set safe zones** – A safe zone is defined for each property, such as atmospheric CO2 should stay between 280 and 320 ppm and get there by 2050. Danger zones are also set to serve as buffers. *The property manager's goal is to keep a property in the safe zone or bring it there in time.*

✓ **3. Charge fees** – A **fee** is a payment to a property owner for the privilege of engaging in activity harmful to the property. Fees are charged for human actions that move a property away from the safe zone. The further a property's level is from the safe zone the higher the fee.

In the old way of thinking a fee is a type of eco tax. In the new way of thinking fees are payments to property owners for use of an environmental service or purchase of an environmental product. Psychologically and legally, fees are a price rather than a tax.

Fees are charged at the most efficient places in the market. For example, a property manager might have gas stations add a fee to the price of gasoline, based on the CO2 emission rate per gallon from the vehicle's latest inspection. The manager would also charge electric power plants a fee per ton of CO2 emitted. *Fees have the effect of gently pushing a property towards the safe zone by saying don't do that.* How fees work to keep properties in their safe zones is shown above.

✓ **4. Pay out buys** – Funds raised from fees go to buys and management expenses. A **buy** is a payment from a property manager to buy a human activity that benefits the property. The biosphere is essentially buying her health by employing her tenants. Examples of buys to help reduce CO2 emissions are R&D funds for alternative energy research and pilot projects, investment credits for wind farms, transfer of alternative energy technology to less developed countries, reforestation, and most important of all, conservation through reduction of energy consumption. Buys rapidly pull a property towards the safe zone by saying "Let's do this instead of that."

The further a property is from the safe zone, the more the fees and so the more funds available for buys. Fees and buys allow both push and pull to be used to keep properties in the safe zone, an extremely efficient form of feedback loops working together. The curve employed prevents shocks to the economic system.

Buys are the key to making the solution work without large disagreeable economic shocks, which is what would happen if fees alone were used.

✓ **5. Fees = Buys + Management Expenses** – Each property is self-managing and self-financing. Management expenses include research, a reasonable profit, data collection costs, enforcement costs, administrative expenses, etc. Because funds from fees are not used elsewhere, such as on income tax reduction, unwanted side effects are avoided. This results in a self-organizing system with sustainable behavior for each property.

✓ **6. Net Income = Sales – Expenses – Pending Fees** – This equation is used by firms or anyone calculating income. Net income, also known as profit, now considers the liabilities of pending fees. The equation provides a new bottom line for corporations.

Pending fees puts an enormous economic incentive on previously difficult to manage behaviors like undisposed nuclear and other toxic wastes. Such liabilities will now have a true, up-to-date valuation.

Buys are a type of sale. Fees are one of a firm's many expenses. Because sales include a firm's buys and expenses include their fees, there is now a clear, tremendous incentive for firms to act sustainably. On top of that is the effect of the price of goods and services they have purchased that themselves have fees and buys. Finally, on top of that is added concern for the future via pending fees. It's a sort of irresistible triple whammy. This results in a self-organizing system with sustainable behavior for each firm. This is critical because corporations are now the dominant agent in the human system.

The beauty of reflective pricing is it causes self-organized sustainable behavior for each property, transaction, and firm, in an entirely self-funded manner. This solves the technical side of the problem in what is probably the most efficient manner possible for free market democracies.

Solution Element 3 – Worldism

Worldism is global cooperation on global problems and opportunities, which is necessary to make and enforce the decisions necessary for a uniform global implementation of Environmental Property Rights. It is the next evolutionary step after nationalism, as nations begin recognizing one by one that many issues like global environmental sustainability supersede national self-interest.

Objective

The objective of worldism is to provide a sufficient amount of global cooperation so that difficult global problems may be proactively and reliably solved. A sub objective of worldism is to replace the nation with the world as the top common identity of most of the world's population.

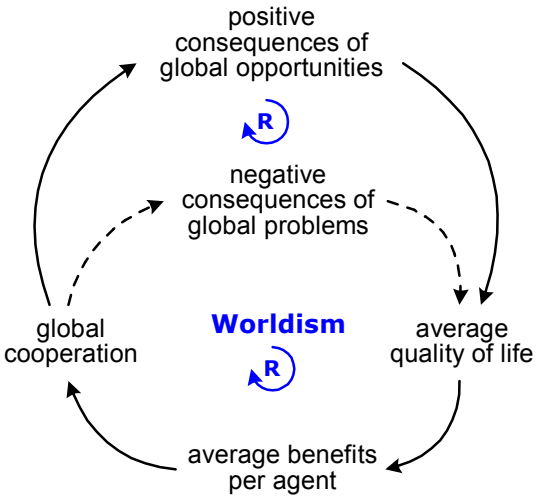
Rationale

Worldism is necessary to manage and enforce worldwide Environmental Property Rights, just as nationalism was necessary for many other basic rights. Without worldism there will be no routine ability to make and enforce global decisions, and thus no reliable way to solve global problems.

Description

Worldism works once the two reinforcing loops shown below are established. Substitute the word "national" for "global," and these are the same loops that drive nationalism and cause it to thrive. Like nationalism, once these loops are established people will not want to turn back. And, like nationalism has since it was invented, the loops will grow stronger and stronger.

The System Forces Pushing Civilization Toward Worldism



Here's how the lower loop works: As global cooperation increases, the negative consequences of global problems decrease. As this happens the average quality of life goes up. As that goes up, so does average benefits per agent, which is a strong incentive to increase global cooperation still more, and the loop starts all over again.

Once humanity gets its global problems under control, it can proceed to pursue global opportunities that it never could before. The only limit to these is our imagination.

Here's how the upper loop works: As global cooperation increases due to the forced necessity of banding together to solve global problems, some of that cooperative force will be channeled toward increasing positive consequences of global opportunities. This will increase

average quality of life. After that, the upper loop works the same as the lower loop.

As the two loops imply, a pleasant "side effect" of Worldism will be the potential solution of many global problems such as conflict, falling or stagnating quality of life, and excessive disparity of wealth. Another is the way new global opportunities can now be pursued more efficiently. But all these have a low priority compared to what is far and away our top priority: the global environmental sustainability problem. This pressing problem is why Worldism is needed now.

Worldism is a beneficial philosophy that places the average quality of life of all people, including those yet to be born, as the top goal of global cooperation. There is now a new topmost omniplex (an omnipresent philosophy) that people feel they belong to and own their allegiance to. Just as nationalism has replaced tribalism and city/states in most of the world, worldism replaces nationalism with a higher and more proper priority—the health and welfare of humanity and the planet as a whole.

Next, let's put all this together into an attractive business model.

The Attractive Business Model

Since I'm not an expert on designing business models, this section is necessarily short and in need of improvement.

It should not be difficult to take the above concepts and create an attractive business model, one so alluring that it attracts millions of entrepreneurs overnight. Once the first few Environmental Property Management (EPM) corporations are established, the rest will have a proven model to follow, and the whoosh of all those managers swooping in to file claims on unclaimed environmental properties will be a replay of the great land rushes in the US in the 19th century, during which millions of acres of land were opened up to settlers for homesteading.

The key elements of a highly attractive business model that I can think of are:

1. A large untapped source of income, which is the *market*.
2. A monopoly or near monopoly on that market for the long term.
3. Low startup investment requirements.
4. A short amount of time between startup and a large return on investment.
5. A high return on investment over a long period of time.
6. Low risk of anything going wrong.

The EPM industry offers all of these. It is probably well over a trillion dollar total market. (Gross World Product was 59 trillion dollars in 2005.) There is, however, a barrier to entry that must be resolved: The first solution element, Environmental Property Rights, does not yet exist.

To resolve that the first few EPMs would need to get together and design a model piece of legislation defining Environmental Property Rights. Then they would need to approach a few agreeable municipalities (small political units such as towns, cities, or counties) and make a pilot program proposal. The proposal would say that the EPMs could manage a few test environmental properties if the new legislation was passed, and the results would greatly benefit the municipalities. Even better, the results would benefit the world, because those forward thinking politicians who were early supports of these new concepts would be helping to pioneer a solution to the global environmental sustainability problem.

Now let's try to translate this potential into the minimum framework for a business model offered by Chesbrough and Rosenbloom, who "list the following six components of the business model:

1. **Value proposition** - A description of the customer problem, the product that addresses the problem, and the value of the product from the customer's perspective.
2. **Market segment** - The group of customers to target, recognizing that different market segments have different needs. Sometimes the potential of an innovation is unlocked only when a different market segment is targeted.
3. **Value chain structure** - The firm's position and activities in the value chain and how the firm will capture part of the value that it creates in the chain.
4. **Revenue generation and margins** - How revenue is generated (sales, leasing, subscription, support, etc.), the cost structure, and target profit margins.
5. **Position in value network** - Identification of competitors, complementors, and any network effects that can be utilized to deliver more value to the customer.
6. **Competitive strategy** - How the company will attempt to develop a sustainable competitive advantage, for example, by means of a cost, differentiation, or niche strategy." [123]

Fitting the Proper Coupling Package solution elements into this framework is relatively straightforward.

In fact it is easy, because Environmental Property Management companies (EPMs) are a type of public utility. Like most utilities, they can take very simple approaches to all of these components. This is because utilities have protected markets and thus have little need to fine tune their business model to be ultra competitive, as the above framework allows.

First we consider the first component. The key to a strong business model is a strong value proposition. The standard EPM value proposition would be something like the summary in the paragraph below, which is what is submitted when a new environmental property claim is filed:

> *We can solve the (name of environmental property) problem in about the fastest time possible, with a very low negative impact on the economy. Here is our property analysis and business plan of how we will manage this property. All we ask in return is the right to exclusive ownership of the property for a period of (x) years, and the right to charge fees as necessary to cover our buys, expenses, and the standard net profit per the published Reward for Wise Stewardship profit curve. Accordingly, we hereby file a claim for (name of environmental property).*

The other five components fall into place easily, because this is a protected market. Thus there is no need to describe the others here, other than to mention that "target profit margins" will run higher than the utility industry, due to the Reward for Wise Stewardship profit curve.

Risk Management

There are a number of risks this chapter has not addressed. These include the inefficiency and corruption that some utility monopolies have exhibited, the use of a causal flow model instead of a system dynamics model to identify the key social structure, the possible problem of overly large EPMs on properties like atmospheric CO2, and more that readers of this chapter are certain to spot. But if the basic strategy is correct, then these are tactical issues that will work themselves out. This leaves the critical question: Is the basic strategy correct?

The process used is the best one I know of for this type of problem. But has the process been applied properly? If it has led to identification of the correct low and high leverage points, then it has, because these form the bedrock of the solution strategy. Solutions to complex social system problems should not attempt to push on low leverage points. Instead solution convergence should seek to find the most efficient, self-managing way possible to push on high leverage points.

No one knows if the correct low and high leverage points have been found. All we have so far is a logically appealing hypothesis of where they are and what will happen if they are pushed. Like all scientific hypotheses, this one can be tested by experimentation. That must be the next step.

The first round of experimentation can be done quickly and cheaply, through the use of artificial world social experiments. It should not be too hard to design a small series of simple experiments that can be run on groups of people that simulate running an actual EPM. This would show whether pushing on these high leverage points would work or not. If this showed the hypothesis to be false, then it's back to the analysis step. But if it showed the hypothesis to be probably true, then the next step would be to perform some experiments on municipalities using model legislation as described earlier. If that looked promising, then this approach could gradually be scaled up until it reached the global level, while still treating every EPM as a tightly controlled experiment. This would allow the body of knowledge needed to address all the risks to be accumulated in a reliable, scientific manner.

Another top risk is that the solution may be insufficiently self-managing and self-funding. If it is, then regression back into unsustainability is unavoidable.

The route to proper coupling lightly sketched in this chapter is specifically designed to address this risk. The very essence of the idea of proper coupling at Thwink.org is that the relationship between two systems that are properly coupled must be self-managing and self-financing. Otherwise they are improperly coupled.

This avoids the trap of requiring continual large amounts of effort and expense, which cannot be sustained. Proper coupling overcomes what Jay Forrester of MIT identified as:

> "The tendency of a [social] system to resist and counteract an applied force... Compensating counteraction can be disastrous if the applied programs are expensive. Only applied programs of intrinsic low cost are feasible." [124]

Another risk is buys depend on large-scale implementation to succeed if work like expensive centralized R&D is required. The high costs of R&D buys need to be spread over many sources of fees so there's a big enough R&D budget to make progress quickly. The benefits, of course, can be spread over many sources of unsustainable behavior.

Summary and Conclusions

The analysis has shown that the reason conventional market driven solutions have failed to solve the sustainability problem is they have been pushing on an intuitively attractive low leverage point. This was identified as indirect utility costs. The analysis also showed that there are two high leverage points that, if pushed on correctly, would solve the problem in a very efficient manner. The two high leverage points are consumption efficiency and consumption cost efficiency.

The strategic key to pushing on these high leverage points correctly is to introduce a new fundamental right that causes the human system to now "want" to solve the sustainability problem. This is common property rights, which are the next evolutionary step after private property rights. Common property rights give the social agents involved very strong incentives to self-manage the system in the best interests of society as a greater whole. All we are doing here is accelerating the natural evolution of the human system in a desired direction, so that we can solve the sustainability problem proactively instead of reactively.

Once society can start building on the new foundation of common property rights, everything else follows naturally, with very little resistance. The introduction of the concept of common property rights would be the precipitating event that would initiate a chain of subsequent events. There are Environmental Property Rights, Reflective Pricing, and Worldism. This chain (or one like it) would appear very quickly, just as the Industrial Revolution did once its fundamental prerequisites were present.

Would this chain be called the Sustainability Revolution? It matters not, as long as it leads humanity into the Age of Transition to Sustainability, at last and in time.

This is an unconventional solution. It defies the popular solutions [125] of quotas, regulations, tradable pollution permits, and the vague, intuitive call for "free market forces" because it takes a completely different approach. The reason the approach is so different is not the novel notions of common property rights, and fees and buys. It is something much deeper. It is the well hidden fact that popular solutions are command and control in disguise. This will not work because it is inherently inefficient. Why this is so is taken up in the next chapter.

Epilogue: The Flaw

This chapter was written in 2006, long before I realized how corrosive the effects of profit maximization can be. Revisiting the chapter in January 2010, it's more solid than I remember except for one serious flaw.

The chapter paints the Proper Coupling Package as "a business model so ethically and financially attractive that its rapid adoption by the global business community would solve the sustainability problem as quickly as is realistically possible." *That would not happen* because the same profit maximization motive that has driven large for-profit corporations to exploit, circumvent, weaken, deregulate and rollback so many other laws would cause the same thing to happen to the intent of Environmental Property Rights. Why I didn't see this before I don't know. Perhaps I was subconsciously still infected by the profit is good meme.

No law can be written to prescribe exact behavior. Laws combine with cultural norms and fundamental social agent goals to steer a social system's behavior. All three, laws, culture, and agent goals, must be right for the emergent outcome to be satisfactory. Of these, agent goals are by far the major determinant of long term outcome, particularly the goals of a system's dominant agents.

Therefore Environmental Property Management should be limited to non-profit corporations. One benefit of this approach is that many environmental NGOs will at last have a viable business model. Another is that as common property rights extend to other aspects of civilization, altruists of all stripes will at last have a viable livelihood.

The non-profit life form has proven to be far more benign than for-profit corporations. When business managers are no longer motivated by maximizing profits for their shareholders, they will instead be motivated by the original purpose of corporations. They were artificial creations designed to provide specific benefits for people as prescribed in their charter, with profits as a distant secondary goal. But over the centuries the life form step by little step changed that to where profits became the primary goal. Today entrepreneurs roam the globe, looking for ever more clever niches where profits can be squeezed out, with little regard for anything else. Stock markets and GDP growth curves have become *the* accepted barometers of the health of nations—when in reality, once the veil of deception is lifted, they measure the health of the New Dominant Life Form by measuring profits and sales.

As long as *corporatis profitis* remains the dominant life form, *Homo sapiens* will find it impossible to proactively solve the global environmental sustainability problem, as well as any other difficult social problem whose solution would benefit the common good.