

Improving the Waste Management Hierarchy

“The Sustainability Hierarchy”



2010 Report Series
The Sustainability Industry
The Envirobiz Group, Inc.

Minneapolis • San Diego

About This Report Series

The Envirobiz Group will be beginning an annual reports series in 2010 whose purpose is to provide strategic vision on how sustainability issues will lead to major changes in the scrap and waste management industry in the coming years. In the first of these special reports, Envirobiz proposes an enhancement of the traditional *waste management hierarchy* to such an extent that it further proposes a name revision as well to the *sustainability hierarchy* that is more appropriate given the scope of the hierarchy. The complete report is available for free in PDF format on Envirobiz.com at <http://www.envirobiz.com/sustainability.asp>.

The overall special report series will provide a vision of the creation of a *sustainability industry* that will be broader in scope than the combination of both today's *scrap and waste management industries*. To receive more information on the future 2010 reports in this series, email sustainability@envirobiz.com.

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Improving the Waste Management Hierarchy

“The Sustainability Hierarchy”

By Mr. Cary Perket

President

The Envirobiz Group

Forward

During the early part of my career, dating back to the early 1970s, the solid waste industry was largely viewed as distinct and separate business from the management of scrap resources. Over time, the distinction between the solid waste management industry and the scrap industry has become increasingly blurred as more emphasis was placed on recycling waste from households and other sources. Today, some of the larger waste management companies revival their counterparts in the scrap metal industry in terms of the amount of resources being recycled.

The premise of this report series is that if we are to understand the future of the solid waste and scrap industry, we need look upon all of the options that we could possibly use in the future for conserving and reusing resources. A corollary to this premise is that expanding world population will inherently lead to increased demand for various resources and accordingly the higher valuation as a result of increased demand will lead to more conservation. Or alternatively, as higher valuation occurs for resources, other alternatives emerge to either replace the resource such as the development of alternative fuels.

Just as the distinction between the solid waste and scrap industries have become increasingly blurred, it is possible that these two industries will also become extensively involved in services that are beyond their current mission. To explore to where their future mission might led, we need to expand the traditional *Waste Management Hierarchy*. More specifically, expand the elements that have been for decades lumped together into the category of “waste avoidance” or “waste prevention”. The result of that expansion leads to a hierarchy that deserves a different name which is propose here be term the *Sustainability Hierarchy* as its hierarchical priority is sustainability of resources.

Introduction

Ideology is used in this paper in the context of a comprehensive vision. The *Sustainability Hierarchy* presented in this paper provides a more comprehensive vision of waste prevention actions that can be undertaken. In as much as some waste prevention actions are not commonly considered waste management activities, the term *Sustainability Hierarchy* is more appropriate name for the ideology than *Waste Management Hierarchy*.

The author's goal in providing this more comprehensive vision is to encourage innovative thinking about waste prevention and in so doing, place greater emphasis on the sustainable use of resources to accomplish waste prevention. In most respects, the resources being recycled from mixed waste collection represent an opportunity for innovators to develop waste prevention options for those resources.

The common cliché of “Thinking Outside of the Box” might be itself modified to “Thinking before the Recycle or Waste Container.” Almost every item that is placed in a recycle or waste container represents a utilization of natural resources, human resources, and energy resources; finding a waste prevention option that makes continued use of the utilization of the those resources is a step toward a sustainable future.

Background

The *Waste Management Hierarchy* is not attributed to a specific individual or group. It first appeared in federal legislation in the Federal Facilities Compliance Act of 1992. But clearly the *Waste Management Hierarchy* was in use for a most of the decade before it was incorporated into the Federal Facilities Compliance Act of 1992. The *Waste Management Hierarchy* is itself an evolution of the waste management ideology of the “3 Rs” to reduce, reuse and recycle.

The *Sustainability Hierarchy*, like the Waste Management Hierarchy, is a statement of ideology. The *Sustainability Hierarchy* embraces all of the ideology found within the *Waste Management Hierarchy*; however, it addresses “waste prevention” with more specifics than the *Waste Management Hierarchy*. Further, the *Sustainability Hierarchy* is arguably more amenable to applying to specific resources.

Evolution of Waste Management Strategy

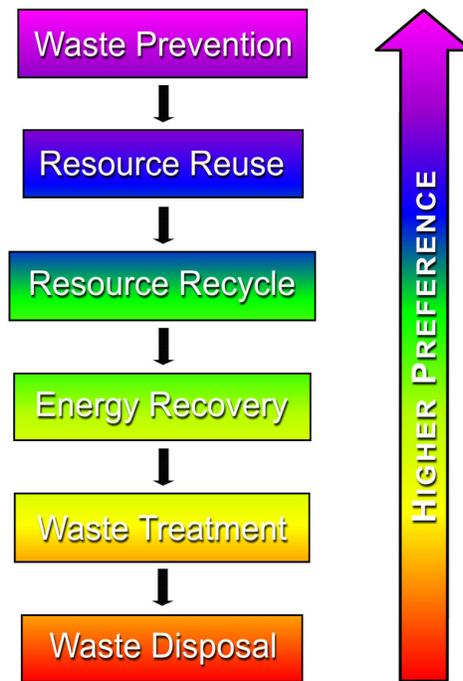
Historically, waste management services throughout the world had the original, primary function to provide protection of public health. Accordingly, the first federal agency to be charged with responsibility for municipal solid waste collection was the United States Public Health Service (USPHS). Correspondingly, the first major federal legislation, the Solid Waste Act of 1965, is primarily focused on public health protection. Correspondingly, the USPHS's original goals in promoting the establishment of sanitary landfills were basically to eliminate public health issues (rodents and other vectors) and nuisances (smoke from open burning, litter, etc.).

An evolution in waste management ideology is reflected in the Resource Recovery Act of 1970. One aspect of the evolution was the incorporation of resource conservation into waste management ideology;

as such it is one of the earliest federal regulations incorporating the ideology of the **3Rs**. It is also significant from a historical perspective as the formal beginning of federal efforts to address the special wastes (e.g., hazardous waste) that were not suitable for disposal in sanitary landfills.

Figure 1

Waste Management Hierarchy



The subsequently passed Resource Conservation and Recovery Act of 1976 (RCRA) is perhaps the most famous of all federal waste management laws. The authorization contained within the original RCRA legislation and its subsequent amendments have been the basis of much of the efforts to implement the original **3Rs** and no doubt a catalyst for the development of the **Waste Management Hierarchy**. The **Waste Management Hierarchy** represents an expansion of the 3Rs ideology in that it indicates a preference for certain types of waste management.

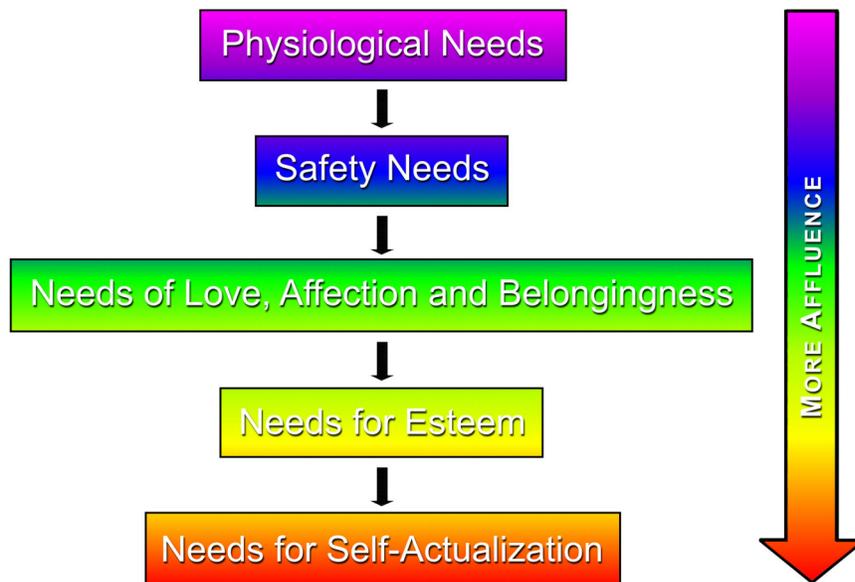
The primary purpose of the Federal Facilities Act of 1992 was to clarify that federal facilities were required to comply with environmental legislation and regulations. Its pertinence here is simply that it was the first time that a version of the **Waste Management Hierarchy** was so embodied in federal legislation. As such, it reflects a benchmark for the adoption of the **Waste Management Hierarchy** (see Figure 1) as a mainstream waste management philosophy.

Maslow’s Hierarchy of Needs

Maslow’s Hierarchy of Needs is a psychology theory proposed by [Abraham Maslow](#) in his 1943 paper *A Theory of Human Motivation*. Its pertinence here is that human needs are the basic reason for human consumption of natural resources and correspondingly human generation of wastes. It is also relevant from the perspective that among the most basic of human needs is public health protection (e.g., sanitation services).

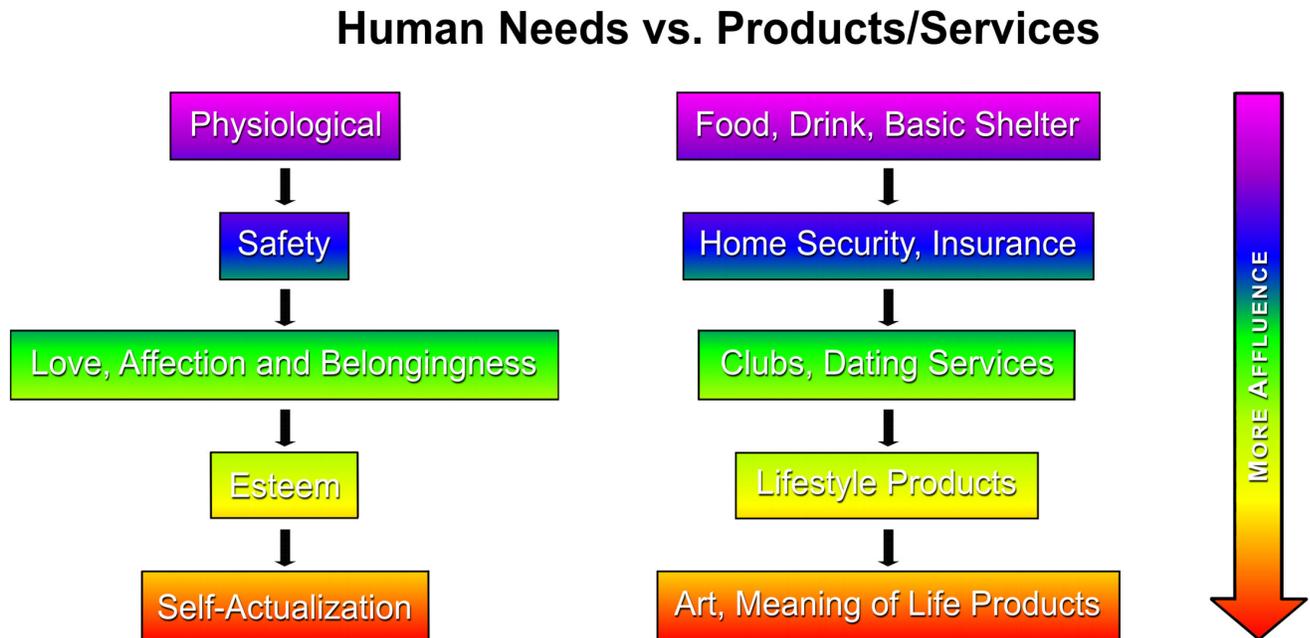
Figure 2
Maslow’s Hierarchy of Needs (1943)

Maslow's Hierarchy of Needs



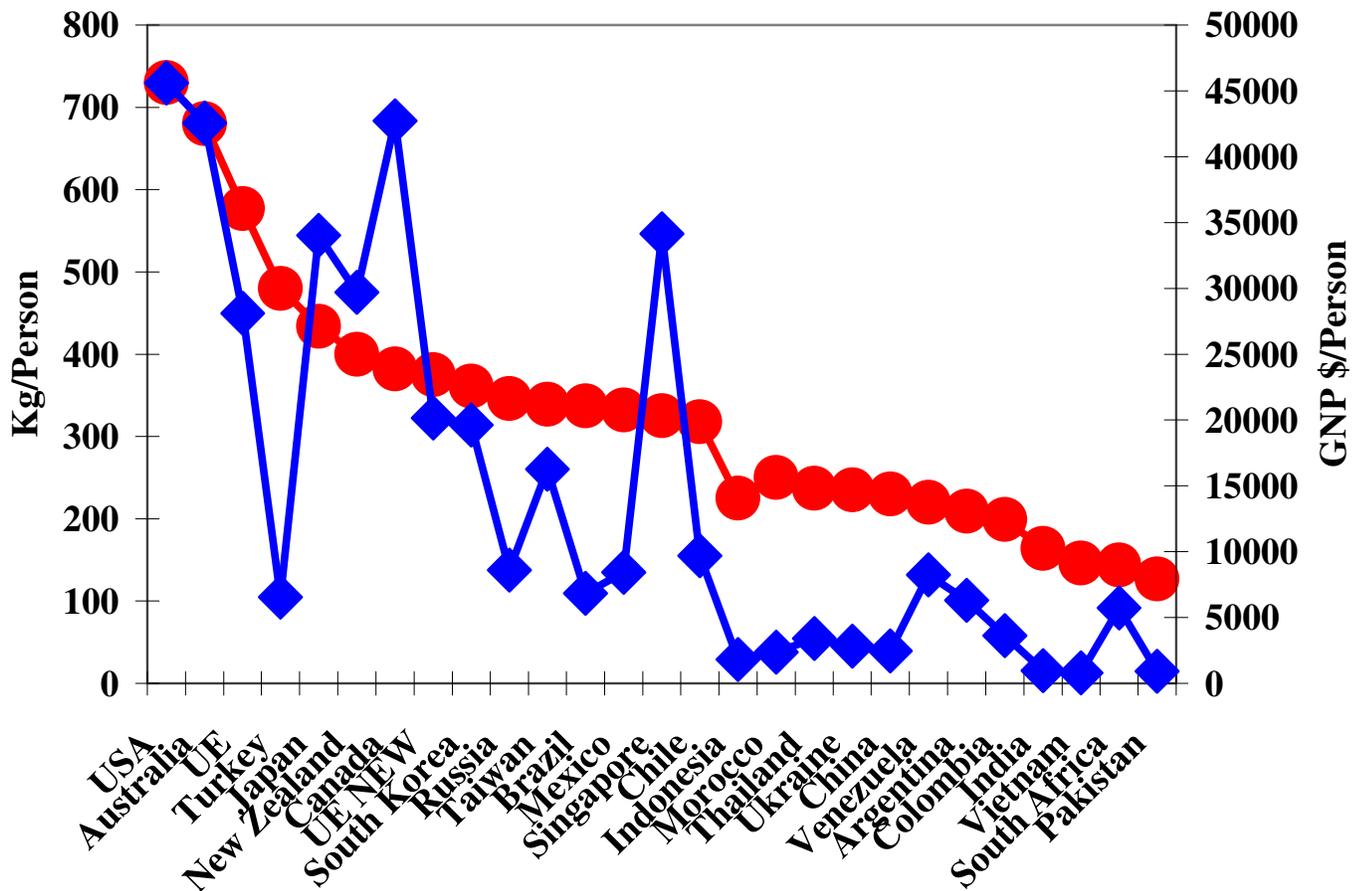
Advertising professionals use *Maslow’s Hierarchy of Needs* as a guideline to determine which markets to target for certain products as well as how to advertise to those markets. In general, *Maslow’s Hierarchy of Needs* indicates that as a society becomes more affluent, it is to be expected that people within the society will increasingly perceive themselves as having more needs (see figure 3). The obvious corollary to *Maslow’s Hierarchy of Needs* is therefore that more affluent societies tend to have greater personal consumption and therefore greater waste management challenges.

Figure 3
Human Needs vs. Products/Services



The extent to which more waste is generated by more affluent societies was recently reported by Philippe Chalmin and Catherine Gaillochet in the 2009 edition of *From Waste to Resources: World Waste Survey* (see Figure 4). Chalmin & Gaillochet statistics indicate very significant differences in waste produced from households with increasing affluence in each country. The inference here is that as other countries develop, there will be greater waste produced as well as greater consumption of natural resources.

Figure 4
Waste Generation vs. Affluence



One of the underlying reasons for advocating the transition to a *Sustainability Hierarchy* is that the amount and types of waste produced, and correspondingly the appropriate waste management option, is directly related to decisions that are initially made about the consumption of natural resources. Therefore giving greater consideration to the conservative use of the natural resource(s) is the only logical approach to the inevitable worldwide increase in human demand. Correspondingly, more emphasis is needed on waste prevention.

“Prevention”

There are numerous versions of the *Waste Management Hierarchy* that consistently give the highest priority to a type of prevention. Some versions of the *Waste Management Hierarchy* use the term “waste reduction,” “waste minimization” and/or “reduce” instead of “prevention.” All three terms are typically used in the very general context of more carefully using raw materials or products so that less waste is generated.

The term, “prevention,” (as well as “waste reduction” or “waste minimization” or “reduce”) is too much of a generalization. Its use in the ***Waste Management Hierarchy*** is the equivalent of consolidating the preferences for types of waste management (e.g., recycling, treatment, and disposal) into a single term “proper waste management.” Furthermore, the use of the general term “prevention” does little to identify who is responsible for prevention.

The ***Sustainability Hierarchy*** elaborates more specifically about waste prevention options. The ***Sustainability Hierarchy*** and the ***Waste Management Hierarchy*** are compatible ideologies. Both ideologies constitute a similar vision of minimizing the impact of waste disposal. However, as an ideology, the ***Sustainability Hierarchy*** is more comprehensive from the perspective that it embodies more specifics about waste prevention options.

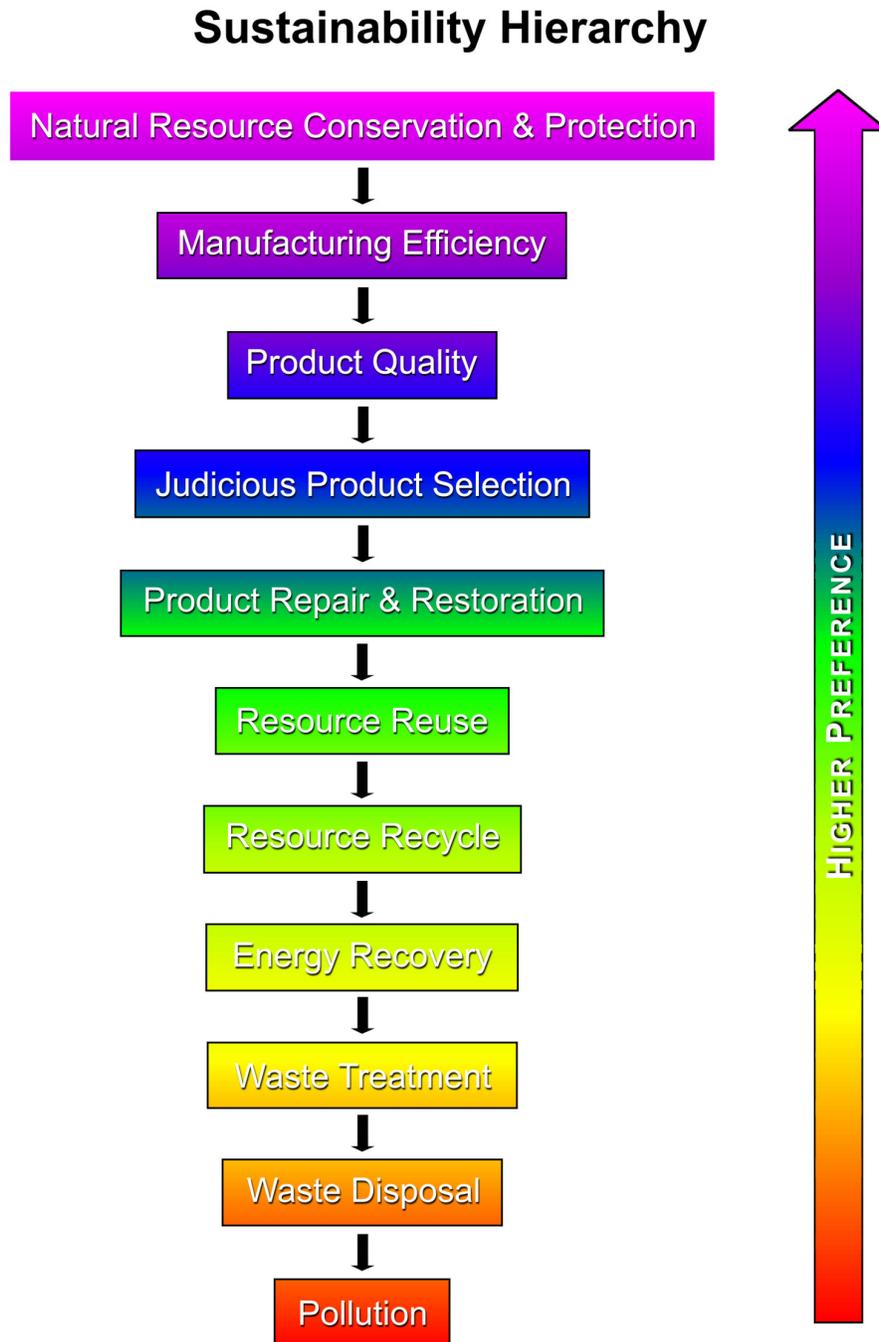
Waste Prevention Options

Some of the most promising prevention options are beyond what one would traditionally consider in the context of “waste management.”

- Natural Resource Conservation & Protection
- Manufacturing Efficiency
- Product Quality
- Judicious Product Selection
- Product Repair & Restoration

The incorporation of these prevention options/strategies results in the proposed ***Sustainability Hierarchy*** (Figure 5) encompasses options that establish responsibilities for entities other than waste management professions and services.

Figure 5
Sustainability Hierarchy (Perket 2009)



The traditional view of waste management was, and to a large extent still is, that the consumer took responsibility for the management of a product after it has been consumed. However various special wastes from households (e.g., automobile batteries, electronic devices, mercury lamps, etc.) that require special waste management have increasingly catalyzed a debate about who should be responsible.

For example, there are advocates of Extended Producer Responsibility (EPR). EPR is based on the concept that all costs associated with a product throughout its life cycle (including waste management costs) should be figured into the market price of the product. In EPR application, the manufacturers of a product are responsible for the product after the product's useful life.

The whole issue of relative responsibility for waste management (as well as overall sustainability) has become more and more contentious and political. The *Sustainability Hierarchy* identifies options that may or may not be applicable for various entities to take some responsibility for prevention, just as the *Waste Management Hierarchy* contains options that may not be feasible for a type of waste.

Natural Resources Conservation & Protection

Climate change discussions have accomplished very little to this date, and they have created contentious debate among nations about responsibility. The probability of similar contentious international debates about the allocation of natural resources increases with each passing day as the rate of consumption of nonrenewable natural resources (crude oil) and dependence on renewal natural resources (drinking water) continues to increase. How climate change is ultimately decided will most probably set a precedent for forthcoming issues about supply and demand for other natural resources.

The demand for limited resources in itself could create a paradigm change in waste management. Higher natural resource pricing tends to (1) reduce consumption; (2) justify greater manufacturing efficiency; (3) change product quality; (4) result in more judicious selection of products by consumers; and (5) create higher value for resources recoverable from waste.

History shows us that waste management problems and short-sighted use of resources naturally arise when resources are abundant. Inexpensive human and/or other natural resources can result in (1) encouragement of one time resource use; (2) less emphasis on manufacturing efficiency with other more critical resources; (3) low product quality resulting in short product life; (4) less discretion by consumers, and (5) recycling costs being financially unattractive. In the perspective of some, this scenario is one in which inexpensive waste management options (e.g., land disposal) is enabling and encouraging virgin resource utilization.

Manufacturing Efficiency

In simplest terms, the cost of manufactured products reflects the collective costs of the resources utilized in its manufacture. The three principle categories of resources utilized are characterized into three categories for this discussion: energy, human, and mineral resources. Manufacturing efficiency tends to get more attention when one or more of the three resources becomes more expensive.

Manufacturing efficiency is typically measured in terms of costs and cost savings. Hence, from a manufacturing perspective, using less expensive human resources is an improvement in manufacturing efficiency. The Bureau of Labor Statistics (BLS), even before the current recession, reported very significant decreases in both the number of manufacturing establishments and manufacturing employment, which the BLS attributed to manufacturers using less expensive foreign labor.

As is evidenced by this trend, the low cost of human resources has become a major competitive advantage for foreign manufacturers. If the United States agrees to unilateral actions to curb emissions from energy production, it will essentially provide another competitive advantage to many of the same countries with inexpensive human resources. Having higher costs for energy and human resources makes it highly improbable that U.S. manufacturers would be able to compete given that price alone is often the key criteria used by consumers.

It is also a contention that foreign manufacturers in some countries have an additional advantage, because laws and regulations that prevent degradation of natural resources like air and water are not enforced or do not exist. Realistically, this is a situation that ultimately leads to serious consequences and undermines sustainability. However, in the short term it can provide an economic advantage.

It is politically incorrect to make analogies comparing the competition between American and foreign manufacturers to battles between war combatants; but the current competition between manufacturers could have outcomes as significant as actual wars. In the great, little book, the “The Art of War,” Sun Tzu in 400 BC discusses combatant strategies taking into consideration both (primarily human) resources and circumstances. Correspondingly, the strategy for efficiently using all resources in manufacturing becomes a key element, both in global competition and national sustainability.

Product Quality

Quality product is used in the *Sustainability Hierarchy* in the context of (1) being of composition and construction that it can serve in its original intended purpose for an extended period of time and/or (2) the design facilitates further productive use of the product for either its original or an alternative use. The underlying ideology is that product quality should be optimizing the use of resources.

Optimizing resources utilization is not always achieved at the manufacturing facility. Resources are also utilized in the distribution, use of the product, and management of the discarded remains of the product. There are clearly situations (e.g., beverages) where optimizing the resource usage is primarily focused on distribution costs of the product and there is not the possibility of extended usage. The shift from traditional glass bottles to aluminum and plastic was and still is a contentious debate since the shift resulted in more plastic wastes (derived from crude oil), but saved energy resources consumed in distribution.

Advocates of Extended Producer Responsibility (EPR) believe it necessary to level the playing field between producers of quality, environmentally friendly products from producers of environmentally unfriendly products. The premise is that requiring the relative costs of the waste management of environmentally unfriendly products be incorporated into the consumer’s initial cost for purchasing a product, it would help the cost competitiveness of environmentally friendly product.

Theoretically, EPR would further provide an incentive to producers to design their products such that upon their product reaching the end of its life cycle, the product could be more easily divided into reusable or recyclable constituents. Theoretically, it would also create a financial incentive to consumers to purchase more environmental friendly products.

Judicious Purchasing

Typically, manufactured goods heading for consumer use pass through a retailer. Retailers have become more proactive in recent years on environmental issues; in fashion terms, green has become the new black for retailers. In many respects, retailers are in a unique position relative to American and foreign manufacturers to make critical decisions about whose products will be offered to their customers. In that role, they are in a position to help insure that products that support long term sustainability are offered to their customers.

The consumer often does not have the knowledge, persuasion and/or financial resources to purchase quality products. The consumer is being constantly exposed to advertisements encouraging new replacements for reasons entirely unrelated to the basic purpose of the product. For example, even basic electronics like cellular telephones and portable computers are now being sold as fashion statements in the media. The reality is that we have a large number of buyers whose transactions do not take into consideration any aspect of the Sustainability Hierarchy.

For consumers that are of the persuasion, there is the challenge of sorting through opposing product claims. My favorite example of the challenge facing consumers is mercury lamps. Once upon a time there were three manufacturers of mercury lamps promoting their lamps as being environmentally friendly. One manufacturer's lamps tested better because iron filings had been added to the lamp constituents; another tested better because ascorbic acid (Vitamin C) had been added to the lights constituents. A third lamp actually had lower concentrations of mercury in the lamp constituents.

Because of my background in chemical engineering, I understand that iron filings and ascorbic acid will make the lamps appear more environmentally benign in USEPA tests, but I also have serious doubts that the additions of those chemicals have any real environmental benefit in real disposal situations. It is not reasonable to expect the average consumer to have this type of expertise; so a basic challenge and opportunity within the Sustainability Hierarchy is to help consumers make judicious purchases of products.

But there is a much more basic issue than giving preference to an environmentally friendly product; it is basically taking the time to question whether we truly need the product. A significant amount of human consumption is not related to fulfilling the fundamental needs in the Maslow Hierarchy of Needs, and a significant amount of consumption is directed at fulfilling those needs is excessive.

Product Repair & Restoration

There are certain products that reach an iconic status in society, products that owners have such pride in that they are willing to spend considerable resources to continue to use the product. However, for the most part, the average person has become conditioned to purchase inexpensive products that will need to be replaced rather than repaired. To a certain extent this conditioning has happened because so-called name brand products that were known for their high quality transitioned to lesser quality products.

Those of us who are “chronologically gifted” can remember American brands whose names represented both quality and prestige on a worldwide basis. In many respects, the future of American manufacturing is its past; most American manufacturing needs to focus on producing quality products whose longevity compensates for the higher costs of our human (and probably energy) resources. Longevity typically requires that the ability to repair and restore be planned in into a product's design.

Realistically, there is a significant percentage of the current American population that simply discards even when it is feasible to repair and restore. This persuasion is likely to change on its own due to financial constraints in American society. But for such a change to occur, products need to be designed so repair and restoration is feasible.

Reuse & Recycling

To fully explore the history of reuse and recycling in the United States, one has to explore the scrap industry, which historically operated salvage yards, secondary smelters, and related facilities. One could argue that recycling dates back to the Declaration of Independence. Some of the signers were foundry owners; foundries have historically relied upon scrap iron and steel as their raw material.

In many respects, we are now pursuing the reuse and recycling of post consumer discards that are less feasible to cost-justify on the basis of the economic value of raw materials. One solution is salvaging more than just the raw materials: find alternative uses for the parts of the manufactured product. Obviously this option would be more feasible if alternative reuse was considered in the original product design.

In the absence of an economic driver, America is increasing the use of regulatory drivers to motivate recycling. The typical reason why an economic driver does not exist is that the cost of procuring and using the virgin raw material is less than the cost of using recycled raw materials when complete lifecycle costs are not factored in through principles like Extended Product Responsibility. Further, the economics of the situation make it more cost effective to dispose of the potential scrap than recycle it.

In some cases, Americans are paying more than the cost of the virgin material to send the “scrap” to foreign manufacturers who already have an economic advantage because of inexpensive human resources. If the foreign manufacturer is able to purchase the scrap at prices below that of virgin materials, then the foreign manufacturer is essentially being subsidized by America to compete with American manufacturers. If you are an unemployed American factory worker, it’s pretty easy to see an inherent flaw in this situation.

Waste-to-Energy, Waste Treatment, and Land Disposal

One of the great paradoxes of current thinking about waste-to-energy is that society accepts the necessity to directly use natural resources for energy generation. However, society is far less accepting of using wastes derived from those same natural resources as fuel for energy production. Logically, if a natural resource which is used as a fuel must also be used for a product and the product can no longer be reused or recycled, it seems logical to harvest the energy value from that waste.

Waste treatment is necessary for some of the resources used in some consumer products. The omission of toxic consumer wastes from the various versions of the waste management hierarchy is simply because the authors are focused on the traditional constituents in residential waste (paper, glass, etc) rather than the special wastes (mercury lamps, electronics, etc.).

The reality of almost any of the above options is that there are discarded fractions that can not be managed by them. These constituents that truly have no other option should be directed toward secure land disposal facilities. In typical Waste Management Hierarchies, land disposal is the least preferable option. Whereas the author agrees that it is preferable to not use land disposal, the author believes that the least preferable option is still another option that is still being practiced.

Pollution

Clearly, there are many parts of the world that do not have the same pollution prevention standards and/or do not rigorously enforce the same pollution prevention standards as the United States. The lack of both provide a short term competitive advantage to their manufacturers that will ultimately lead to serious cleanup problems similar to what the United States addressed under Superfund. In some respects, Americans are unknowingly enabling this to happen by purchasing products that are manufactured under these circumstances.

Underlying the already contentious discussions about global warming is a more contentious debate about some foreign manufacturing in “developing countries” operating in a manner that is polluting well beyond levels allowed by manufacturers in the European Union, Japan, the United States and other developed nations. Further the nature of this pollution is threatening yet another resource; our oceans and the oceans' food supply.

Human Needs

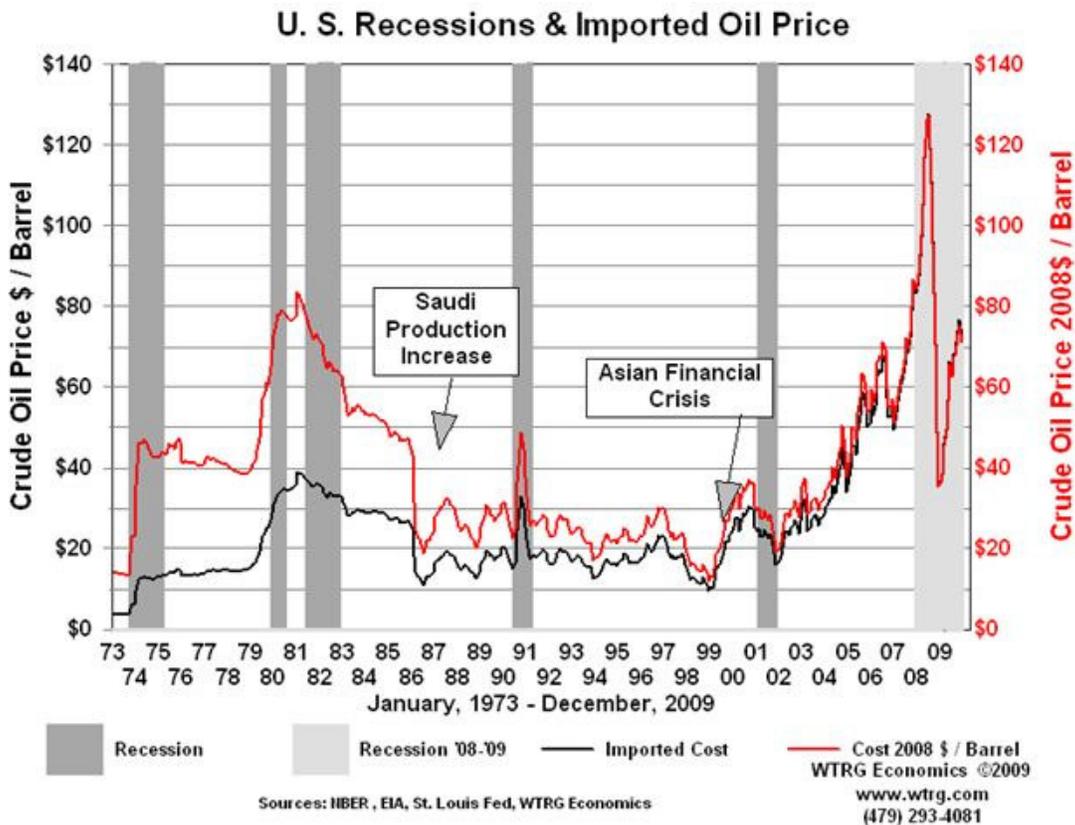
There are certain human needs that must be sustained for an orderly society. When a government can not provide for those basic needs, it faces serious crisis. In 1979, China implemented what is known in the West as the One Child Policy to a portion of its population. It did so because it was facing a potential inability to provide basic human needs of its population that was already at that time about a billion people; the population even with the One Child Policy has reached over 1.3 billion. It is a policy that China believes has prevented its population growth by an amount greater than the entire population of the United States since 1979.

China's policy is a controversial one that has social consequences beyond the scope of this paper. But its actions stand as an important harbinger of the type of actions that could become necessary to provide for the world's overall growing populations. India, which is projected to overtake China as the world's most populated country by 2025, will be another important case example to watch in terms of a government's ability or inability to support basic human needs.

At the climate change conference in Denmark (2009), China took a position that controlling population growth needs to be part of the formula for moderating climate change. In many respects, China’s position on this matter is a harbinger of future resource debates. With a worldwide population that is increasing, the consumption and competition of resources will become a more contentious international issue. One of the best resources to illustrate this point is crude oil.

Since the 1970s, the United States has experienced a series of recessions; most of these recessions had an underlying factor of high costs for energy resources. The relationship between these recessions and crude oil prices has been illustrated repeatedly in the *Energy Economist* by Mr. James Williams (see Figure 6). In the case of oil, we also have an illustration of how other factors like international politics and financial speculation make the availability of resources more complicated than simply supply and demand.

Figure 6
Crude Oil Price s vs. Recessions



In Summary

The *Sustainability Hierarchy's* principle advantage over the *Waste Management Hierarchy* as an ideology is that it elaborates on the opportunities for waste prevention. In so doing, the Sustainability Hierarchy also helps organize the specific roles that entities involved in the life cycle of a resource can play in optimizing its usage. In so doing, the *Sustainability Hierarchy* will hopefully encourage imaginative waste prevention actions that will allow sustained reuse of more the energy, human, and mineral resources invested in the products.

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Williams, James, President, WTRG Economics

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