Quality and the Seven Environmental Challenges of the Planet

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Abstract:

The environmental issues of today constitute a global crisis. There are, from a human point of view, real dangers to survival. Yet there are those who know nothing of this, and those, including political leaders, who are in denial. The threat emanates not just from the climate crisis, as many assume, but from a group of at least seven interacting factors. Our food habits, resource depletion, pollution from a host of wastes, both degenerative and potentially communicable diseases, the electromagnetic radiation we are exposed to, our galloping population and of course the greenhouse trap combine to pose a magnitude of threat humans have no previous experience solving.

The solutions to these problems have to come from leaders who think from a global mindset rather than from ethnocentric positions. Nation states that fiercely argue for their own perceived interests rather than for the planet's requirements can only obstruct potential solutions. Some global efforts are nevertheless in sight. The Brundtland Commission defined Sustainability as meeting the needs of the present without compromising the ability of future generations to meet their own needs. Such a statement marks a measure of progress in thought. A closer examination will however show that it isn't enough. It is not possible to fulfill present 'needs' within current paradigms for any length of time without compromising the future.

Quality management as a discipline has the tools and methods to help develop new technologies and systems with the cooperation of everyone. Now is the time for this discipline to work with scientists, technologists and world leaders to enable effective countermeasures to the seven deadly factors we are up against. Our attention has to shift a little from the corporate world where quality professionals for the most part have lost their hearing anyway.

In so doing, quality management has to redefine itself, and quality itself needs a new definition. What actions must the world prioritize? How can we pick the priorities? This presentation has some propositions on these issues.

Keywords: Sustainability, Planet Earth, Quality definition, Priorities, Analytical hierarchy process

1. The Seven Concerns:

In recent times, climate change has dominated all debates about environment. Although recognizing multiple challenges, the former Vice-President of USA, Al Gore (2000, 2008), has spearheaded a single-minded global campaign to reverse or cap the warming of the earth. There are others (for example, Planet Earth Herald) who place population growth on top and climate change next out of as many as ten environmental challenges. Ramanathan (2008) named six top concerns, expanded to seven in 2012. Underlying the concerns is the possibility of civilizational collapse – by no means unimaginable. (Diamond, 2006)

Of course, planet earth can continue to exist with or without humans. Taken in this sense, there would be no need to learn or do anything about the environment. Implicit therefore is the idea that the earth must continue to be basically habitable to the human race for a long time. This thought goes a little beyond the

idea of sustainability which dominates the dialogue on the subject, as sustainability is about whether what we have can last over time. But we also need to improve what we have got the earth down to, implying lifestyle and paradigm changes.

This paper aims to explore an approach from a quality management viewpoint to help mitigate the impact of the challenges, and help prioritize possible countermeasures - using the analytical hierarchy process (Saaty, 1990).

The seven challenges are shown in Figure 1. Each of these challenges is briefly explained.

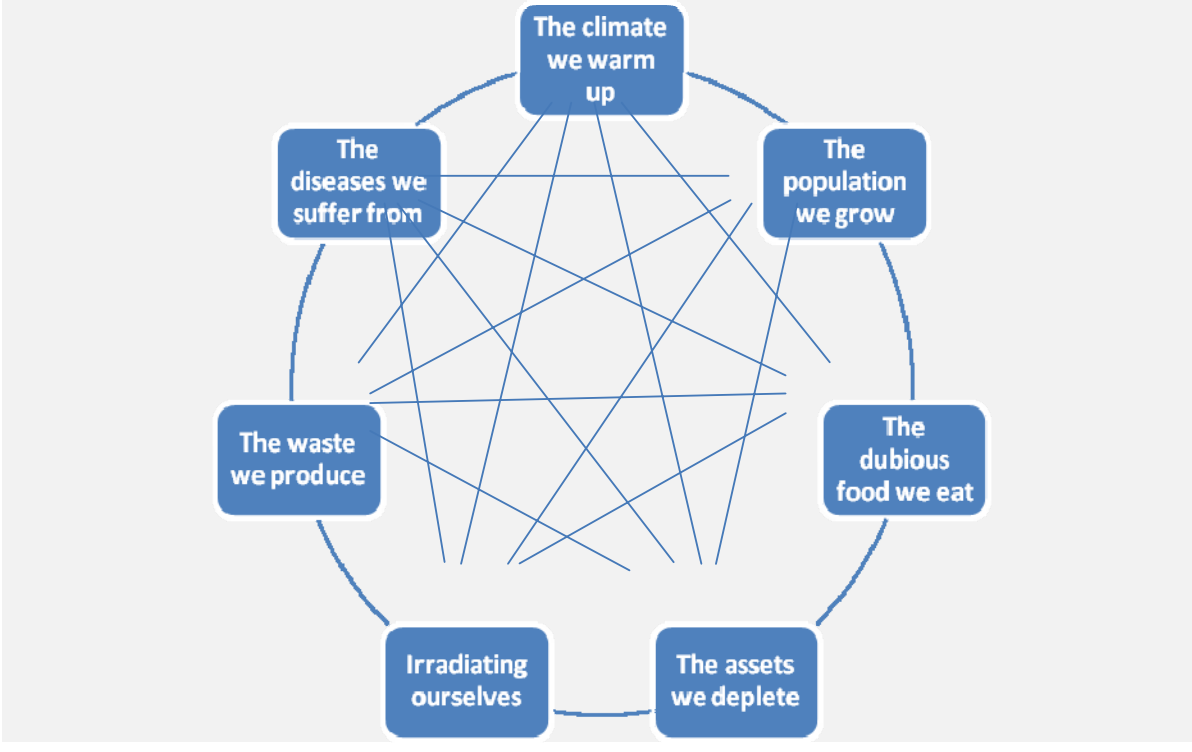

Figure 1: The Seven Concerns of Planet Earth

1.1 The Dubious Food We Eat: General nutrition, average height and longevity of humans have continually risen for many decades now. Nevertheless, the kind of food we eat in modern times also impacts the earth while it also damages the health of people. There is now greater control over pesticide use or air pollution in the developed world, ever since Rachel Carson (1962) published *Silent Spring*. Still, pesticides damage both our food and water in large parts of the world. The use of chemical fertilizers has not only depleted the soil of its nutrients, and caused more salinity but there is evidence that the crops are nutritionally deficient compared to organically grown food. Further, industrialization of farming and food processing means that animals reared for meat are fed hormones as well as nearly half of all antibiotics produced (using US figures). Processed food carries chemicals whose content seems so determined by industry lobby that Sweden actually threatened to sue EU (The Hindu, 2014) for inaction on this score, citing severe health risks. The “100%” juices we drink, having been pasteurized, have had their enzymes destroyed. The consumption of refined flour and sugar which dominate the food shops and of edible oils (wherein the word ‘refined’ masks the fact of chemical and thermal treatment that enhances only shelf life) has been cited for diverse health risks– including cancer. Cancer and other risks are also attributable to processed food, almost always high in salt, and a variety of chemicals and additives.

(Schweitzer, 1954, quoted by Gerson, 2001). There is thus a formidable array of questions about our eating habits, which may require fundamental change.

1.2 The Resources We Deplete: The resources of the earth are obviously finite, and constitute assets that are being depleted rapidly. Depletion of fossil fuels and minerals or extinction of species is irreplaceable. Loss of top soil (Gore, 2000), rain forests, or genetic diversity are already at crisis stage. Minerals, metal ores or fossil fuels are all being exhausted rapidly. Overfishing has depleted some marine fisheries to dangerously low levels. In addition, the loss of fresh water to less accessible sites on earth is looming as an imminent threat. It seems that mankind, acting out of ignorance and greed, can exhaust the assets of the earth in just a few hundred years of industrial 'civilization'. Yet, nothing in our economic system costs the loss of these resources!

1.3 The Waste We Produce: The rate at which unwanted materials from production and consumption accumulate on earth is clearly unsustainable. It is estimated that we now produce some 500,000 chemicals – the toxicity of many of which are reported in Chemical Abstracts as 'unknown'. Chemical waste including but not limited to pesticides has now penetrated our soil, water and air, posing the bulk of the problem of hazardous waste – represented as pollution. Nuclear waste is deadlier, but less pervasive. In addition we now have mounting problems with medical waste including infectious types. The disposal of electronic waste remains a challenge. The segregation of municipal waste disposal has proved testing, and landfills have been controversial. The methane potential of this waste is scarcely tapped, adding to climate worries as well. Food packaging chokes municipal waste, using materials such as polyester that has a half-life of over 100,000 years, virtually making its safe disposal infeasible. Here again, the pricing or taxation mechanisms do not seem to address the cost of such waste generation and management.

1.4 The Diseases We Suffer From: No discussionon sustainability can ignore the consequences of actions by humans on their own diseases. Diamond (1997) shows the historical linkage of close habitation with animals and most infectious diseases, as exemplified in recent outbreaks of SARS or H1N1. The poorer world is most stricken by such diseases as malaria, while the spread of AIDS has been across the world. Research on tropical diseases is wanting, partly because the drug industry cannot see much profit from it. On the other hand, degenerative, lifestyle ailments such as heart disease, diabetes, cancer or even allergies have been continuously on the rise across the world. W.H.O warns that new cancer cases could rise to 15 million by the year 2020. The degenerative diseases are directly linked to the production of hazardous waste (pollution) and residues, and to a degree, radiation. Malnutrition, especially of children, coexisting with a crisis of obesity, is said to cause as many as three million child deaths a year, while the Millennium Development Goal of hunger for under 5% of the world population for world for 2015 has been missed, with 10% still hungry. Then there is the rise of mental diseases, wherein W.H.O in its 2001 report had warned that one in four individuals would experience mental illness sometime in their lives. Despite rising life expectancies, impaired health should thus figure as a key problem of mankind that deserves to be placed in the list of environmental challenges.

1.5 The Climate We Warm Up: If the early sixties were characterized by (fairly successful) campaigns against chemical pollution, especially from what Carson (1962) called biocides, current discussions on environment are pivoted on the crisis of climate change. In Copenhagen in 2009 world leaders had 'agreed' in a non-binding way to cap global temperature rise at 2 degrees Celsius – in itself potentially catastrophic. Global plans, mired in political negotiations, are nowhere in place to achieve even this target. According to the Inter-Governmental Panel on Climate Change (IPCC) global average temperatures have risen by 0.85 degrees Celsius between 1880 and 2012. The ten warmest years have all been from 1998. Global CO_2 emissions have risen in 2013 to 35.3 billion tonnes – 35% over 2002. It is established that this level of CO_2 accumulations arise from human activity and the correlation between CO_2 levels, now approaching 400 ppm, and global temperatures is very high. What is more, Solomon *et al* (2008) warn that temperatures may not fall for a thousand years after atmospheric CO_2 ceases to rise.

The effects of global warming are well documented. As ice melts, the sea levels will rise. Hurricanes and storms will increase, and both floods and droughts will occur with greater frequency and severity. Fresh water availability will be stressed and there will be increased incidence of diseases (such as malaria). Disturbed ecosystems will speed up extinction of many species. If such be the effect of industrial activity, how should one rate the success of quality management?

1.6 The Population We Grow: Growth rates in population are of course shrinking in all parts of the world, possibly arising from lower poverty rates and better education especially of females. But there are also reports coming in of declining fertility rates attributed to environmental contaminants or GM foods. There seems little chance of stabilizing world population at less than 10 billion. Within the paradigms of current economic progress and the legitimate aspirations of the poor, this level is by no means sustainable. The pressure on resources and the burgeoning waste will cause unprecedented effects. Klein (2014) opposes the counting of population growth as an environmental concern because it may work against the poorer nations which contributed least to climate warming. Gore (2000) and many others see it as a significant threat to the planet.

1.7 Irradiating Ourselves: Nuclear power plantshave caused too many sporadic cases of dangerous leaks and hazardous radiation to be ignored. The pressure of climate change means that the exploration of 'safer' but not foolproof nuclear power is inevitable. But there are other radiation hazards now. W.H.O now places the carcinogenic hazard form microwave radiation – largely from the ubiquitous cell phones, and towers and wireless routers to be of the same order as lead, engine exhaust and chloroform. Radiation from high tension cables, often passing close to populated areas, and also the administration of 'excessive' medical radiation add to the overall hazards.

2. New Definition of Quality:

Canthe problems of the world described here be claimed to be unrelated to quality? Within the limited sense in which quality is defined currently, it may be possible for the food processing industry, to take but one example, to deny that they have in any way failed with respect to quality, having satisfied customer tastes and conformed to regulations. But since when has conforming to regulations been accepted as quality? If the health of not only the users but that of the society which has also to deal with the discarded packaging of the food is impaired, then questions do arise. When this problem is expanded to future generations as well as future ecosystems within which humans must live responsibly, the need for a broader definition of quality appears. The Brundtland Commission report (1987) demanded sustainability, which it definedasmeeting the needs of the present without compromising the ability of future generations to meet their own needs. Taking all these points together, a more far reaching definition of quality (Ramanathan 2008) emerges. Quality, then, is to:

Fulfill stated, implied and latent needs of customers in a manner that preserves the earth not only for future generations of humans but for all living things.

Under such a definition, how would industry worldwide fare? We are talking here of not only the food processing industry, but the gamut of industrial agriculture, the drug industry, corporate medical care, the chemical industry, particularly the agro-chemical, the mining and fossil fuel industry, energy producers, and yes the engineering industry with automobiles at its core. In fact every business and indeed every government will have something to answer for.

It is as if the last sixty five years of quality management represent an era at its end, ushering in a new era with a quality direction that just about calls for a start from scratch on a new path.

3. Countermeasures:

For tackling such a potent combination of difficulties confronting the whole earth, there cannot be a magic bullet that resolves all problems. There have to be countermeasures at multiple levels, from local village and town councils to provincial and national governments, and of course collective global action. This paper will focus on global measures. Then again, there are technical challenges. Many have been addressed to a great degree, and will get refined. Solar panels,for example, have become more efficient while their cost keeps going down. But there are also technical issues which have defied feasible solutions for now – storage of energy for example. There are many who believe that some magical new technology will save the planet. However, history tells us that the human challenges are often greater than the technical ones. Can people and governments across the world cooperate in the interest of the survival of the human species, which may mean not hanging on to advantages that particular groups may currently enjoy? On a positive note, there have been cases of international cooperation in recent times, such as the Montreal Protocol.

Activists have questioned the ability of the market economy to accept reforms that may impinge on their profits (Klein, 2014), leave alone reforming themselves from within. It is in general true that current problems cannot be resolved by those in contemporary average levels of human progression. However, solutions that are dissociated from current thinking and hence looking down on the vast majority of people, cannot hope to succeed. For global countermeasures to succeed, they must in part talk the language of market economy, and not hesitate to use pricing and money levers.

Some plausible countermeasures at the world level are:

1. Put a price on carbon
2. Supplant GDP with modified measurements
3. Supplement GDP with well-being indices
4. Mandate taxes based on environment in place of other systems
5. Mandate standards for forestry, water use etc.
6. Mandate new laws on packaged food, tobacco use, disclosures…
7. Create fund paid into by countries which exceed standard ratios

There are other possibilities but these may strike too hard at the votaries of free markets to be able, for now, to succeed - for example, deindustrializing agriculture, sickness care and medical drugs.

In this paper, just four countermeasures have been picked up, primarily to demonstrate the Analytical Hierarchy Process (AHP) for determining relative priorities and demonstrating the value of a package of measures rather than just one solution.

The four chosen countermeasures, each of them meant to be globally applied, are:

1. Supplant GDP (with other measures)
2. Price carbon
3. Recast taxes, based non environment
4. Create fund based on ratios

3.1 Supplant GDP: From the times of Keynes, Gross Domestic Product, an economic measure based on production, has been the foremost, often the only, metric driving economists and governments. Coming from an era where the earth's resources were considered practically infinite, GDP does not subtract the value of resources depleted or the value of environmental degradation as a cost. Since it is, unlike the Net Domestic Product, a gross measure, depreciation is not treated as a cost either. There are other difficulties: inequitable distribution of income does not affect GDP, and value added in households is not accounted for. Clearly a new measure needs to supplant GDP, and one possibility is the 'ea-NDP' (Stiglitz et al, 2010) which aims to deduct depreciation, resource depletion and degradation of the quality of resources from the GDP. In addition, instead of a single measure, multiple measures of well-being should be used by governments. Much work has already been done to evolve such measures. Supplanting GDP could have the significant effect of motivating leaders away from just production to a more holistic view of development.

3.2 Price Carbon: This has been the most popular of all proposals among environmentalists. Of course it would work only if the whole world participates, and the rate for CO_2emission is fixed – some propose $50 per tonne. It would be a tax on those that release CO_2 or its equivalents (methane or the refrigerants under phase-out are greenhouse gases far more potent than CO_2 and are valued accordingly). It is a language that corporates would understand and thus be a direct motivator. And the effect of this measure will go beyond climate change. What about compensation for building CO_2 to current levels? Some say that the polluters have to pay for their excess from the time of the industrial revolution. In any case, some cutoff date is necessary. It cannot be that the penalties for today's accumulations can simply be waived off for the richest countries.

3.3 Recast Taxes Based on Environment: The current taxation system comprising income taxes and some forms of goods and services or value-add taxes can at last be attenuated if not abolished altogether, and replaced by taxes based on environment, often levied at source. These taxes should cover the cost of depletion of resources such as fossil fuels, minerals, forests etc. and also the cost of environmental degradation. For example what is the cost of disposal of a polyester chips packet, which may have a half-life in excess of 100000 years? Or the cost of emissions carrying lead or NOx, or pollution of the soil by pesticides? These taxes will be over and above the carbon tax which is a special case in its own right. These taxes will provide a powerful disincentive for corporates to engage in activities that discharge pollutants – solid, liquid or gaseous.

3.4 Create Fund Based on Ratios: It would be inappropriate to let companies pay their way out of CO_2 emissions, without any other restraint. So, the proposal would be for countries that exceed certain ratios (for example, to GDP) to pay into an international fund.Standard ratios should be agreed to – for example, CO_2, tree cover ratio or population growth rate, and countries that exceed the standards should pay into an international fund meant to rejuvenate the planet. Thus, for instance, Indonesia or Brazil would recognize that its forest cover has value and depleting it will cost money. This fund will also include cost of using common resources – such as fishing in international seas or extracting minerals in Antarctica. Based as it is on paying money, this too is in synchrony with the principles of market economy, and might find adherents.

It is now time to evaluate how these countermeasures will impact the seven global challenges. It is not the claim of this paper that the above countermeasures are perfect or that they are the only important ones. Rather the purpose is to illustrate how a package of countermeasures can be evaluated for relative impact and importance. World leaders will ask to know about such relative importance before they can take radical decisions.

4 The Analytical Hierarchy Process:

We now have seven challenges, and four potential countermeasures. It is time to apply quality management techniques to develop a sense of priorities. The method chosen here is the analytical hierarchy process (AHP) propounded by Thomas Saaty (1980). AHP is a method for breaking a complex, unstructured situation down into its component parts, arranging these parts into a hierarchic order, assigning numerical values to subjective judgments on the relative importance of each part, and synthesizing the judgments to determine which parts have the highest priority and should be acted upon to influence the outcome of the situation.

AHP also provides an effective structure for group decision making by imposing a discipline on the group's thought processes.

AHP enables us to structure a system and its environment into mutually interacting parts and then to synthesize them by measuring and ranking the impact of these parts on the entire system.

Figure 2 illustrates a possible hierarchical structure for addressing the planet earth challenge. The objective – in the top centre - is to preserve the earth. Of course the earth would exist without humans, so the objective implies that it will remain fit for wholesome human existence.

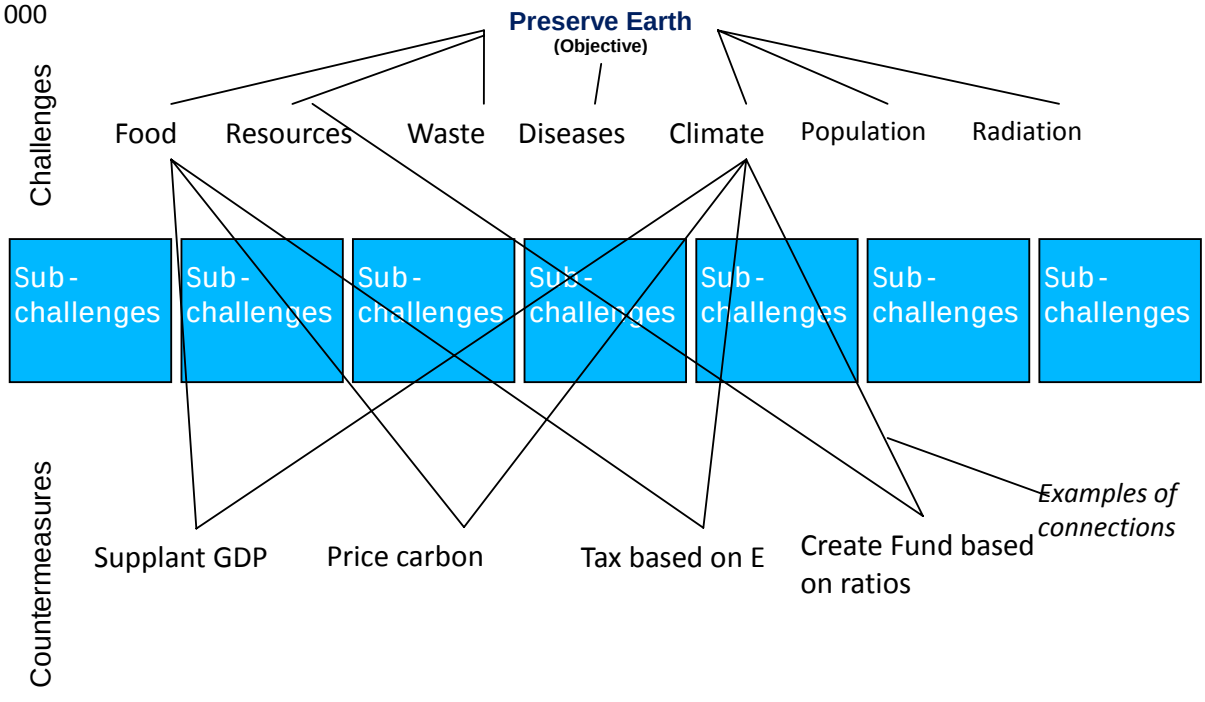

Figure 2: The Hierarchy of the seven challenges and the four countermeasures

Under that are the seven concerns or challenges in the way of the objective, which have already been described together with sub-challenges as well. The sub-concerns are not listed or acted upon for the purpose of this exercise, in order to keep it simple. The four countermeasures are listed at the bottom, and each is connected to each of the seven challenges. This completes the hierarchy.

The next step would be to make paired comparisons of each of the seven challenges – the matrix would call for twenty-one decisions, leading to quantified priorities. For quantifying the relative importance of each pair Saaty (2007) defined a scale of 1 to 9, with the number 1 denoting parity. 3 would constitute

moderate importance, 5, strong importance, 7, very strong importance, and 9, extreme and proven importance. The intermediate numbers indicate positions between the odd numbers.The group is asked to discuss the comparison row-wise, and then score them. If the row item is more important than the column item a number from 1 to 9 is inserted. If the row item is less important than the column item then the reciprocal of the importance number is entered. When group members give out these scores, then a geometric mean is taken. When the matrix is completed the ratings are normalized so that relative importance can be found on a ratio scale. Sometimes, the paired ratings may contradict each other, and thus the matrix may turn inconsistent. Inconsistency is quantified and then compared with inconsistency of a random matrix. If the resultant ratio is 0.1 or less, the matrix inconsistency is acceptable.

5 Priority Scores:

5.1 Priority Score of Each Challenge: Using this method, a group of Fellows and Associates of the Indian branch of the international organization LEAD (Leadership for Environment and Development) prioritized the seven challenges, at a workshop. The question asked of the group was: For preserving planet earth (for humans), between X in the row and Y in the column, which is the challenge of greater importance, and to what intensity (using the 1 to 9 scale)? Geometric means of their scores were entered in the matrix. The exercise was iterated till the inconsistency ratio was down to 0.11.

Preserve Planet Earth	Food Quality	Resource depletion	Waste generation	Diseases	Climate warming	Population rise	Radiation hazards	weight
Food Quality	1	2/7	7/8	1 4/5	1/4	1/4	3/8	0.061
Resource depletion	3 3/5	1	2 2/7	1 2/3	3/8	1/6	7/8	0.116
Waste generation	1 1/7	4/9	1	6	1/2	1/4	2 1/4	0.125
Diseases	5/9	3/5	1/6	1	2/9	1/4	1 2/3	0.057
Climate warming	4 1/8	2 2/3	2	4 2/3	1	1 3/5	4 1/3	0.276
Population rise	3 5/7	6 1/5	4 1/3	3 3/4	5/8	1	3 3/4	0.291
Radiation hazards	2 5/7	1 1/7	1/7	3/5	2/9	1/4	1	0.073

Table 1: Priorities for the seven challenges

The summary of the priorities for the seven environmental challenges of the world are shown in Table 1. This produced a surprise – population rise came out as the most important, closely followed by climate change. Between them they account for 57.7% of the importance. Of the other five, waste generation and resource depletion together account for 24.1% of the total weight. Population growth might not be a popular factor in the post-modernist western world, but it dominates the priorities in poor India!

5.2 Priorities of the Four Countermeasures: Partly by the LEAD team and partly by other interested professionals, seven matrices were drawn for the countermeasure – one for each challenge. The question asked was: To address the challenge of (say, resource depletion), between countermeasure X in the row and the countermeasure Y in the column, which would be more effective, and by what intensity? The inconsistency ratio for every matrix was less than 0.1. The summary result for resource depletion, for instance, is shown in Table 2. Pricing carbon has a comparatively low importance here! Taxing environmental degradation and creating a fund based on ratios have between them 73.1% of the importance. Even a motivational countermeasure that requires no cash outflow has a weight as high as 18.1%.

Resource Depletion	Supplant GDP	Price carbon	Environ-ment taxation	Fund based on ratios	Weight
Supplant GDP	**1**	**4**	**2/5**	**2/7**	**0.185**
Price carbon	**1/4**	**1**	**2/7**	**2/7**	**0.084**
Environmental taxation	**2 4/9**	**3 1/2**	**1**	**1 2/5**	**0.380**
Fund based on ratios	**3 1/2**	**3 1/2**	**5/7**	**1**	**0.351**

Table 2: Priority of countermeasures for resource depletion

Table 3 below shows the weightages for waste generation. Pricing carbon tops closely followed by environment based taxation – together accounting for 73.3 % of importance.

Waste Generation	Supplant GDP	Price carbon	Environ-ment taxation	Fund based on ratios	Weight
Supplant GDP	**1**	**½**	**¼**	**5/7**	**0.124**
Price carbon	**2**	**1**	**2**	**2 4/9**	**0.388**
Environmental taxation	**4**	**½**	**1**	**3**	**0.345**
Fund based on ratios	**1 2/5**	**2/5**	**1/3**	**1**	**0.143**

Table 3: Priority of countermeasures for waste generation

Table 4 is about climate change, and the numbers here are obvious – pricing CO_2 tops with a weight of 42.8%, but the combined weight of environment taxation and fund amounts to 47.8%. By now it must be obvious that while each countermeasure does have an impact on the planet earth concerns, its relative importance is not the same for every concern. Thus a clutch of countermeasures is needed – there is no one magic bullet.

Climate Change	Supplant GDP	Price carbon	Environ-ment taxation	Fund based on ratios	Weight
Supplant GDP	**1**	**¼**	**2/5**	**1/3**	**0.093**
Price carbon	**4**	**1**	**2**	**2**	**0.428**
Environmental taxation	**2 4/9**	**½**	**1**	**2**	**0.272**
Fund based on ratios	**3**	**½**	**½**	**1**	**0.206**

Table 4: Priority of countermeasures for climate change

The population matrix was attempted but dropped because these four countermeasures are not the most effective ones for reducing population growth, which requires another set of countermeasures. The other three matrices were made, but are not shown here in the interests of space, though their weights can be seen in Table 6.

5.3 Recasting Priorities after Dropping Population: As population is dropped from this exercise, the relative priorities of the remaining six challenges have to be recast. The new weights are shown in Table 5. The weightage for climate now rises to 38.9%, a clear first.

Challenges	Weightage including Population	Weightage excluding population
The Dubious food we eat	**0.061**	**0.086**
The Resources we deplete	**0.116**	**0.164**
The Waste we produce	**0.125**	**0.176**
The Diseases we treat	**0.057**	**0.080**
The Climate we warm up	**0.276**	**0.389**
The population we grow	**0.291**	
Irradiating ourselves	**0.073**	**0.103**

Table 5: Renormalized priorities of the six challenges

5.4 Final, Overall Priorities of the Four Countermeasures: By applying the weight of each challenge to the countermeasure-priority for that challenge, and adding such a product for the six challenges in respect of each countermeasure we can get the overall priorities as shown in Table 6.

The results may surprise many.Taxing for environmental impact rated overall as effective as, or slightly more effective than pricing carbon. Environment-centred taxation has been talked about, and some countries have made a beginning, but its potential for replacing current taxation systems needs fuller consideration and study. An international fund based on ratios does show potential too, while a purely motivational tool like supplanting GDP with more relevant measures should not be ignored either.

Preserving Planet Earth	Food quality	Resource depletion	Waste generation	Diseases	Climate warming	Radiation	Weighted totals
	0.086	**0.164**	**0.176**	**0.080**	**0.389**	**0.103**	**1.00**
Supplant GDP	**0.100**	**0.185**	**0.124**	**0.218**	**0.093**	**0.188**	**0.134**
Price carbon	**0.488**	**0.084**	**0.388**	**0.175**	**0.428**	**0.067**	**0.311**
Environmental taxation	**0.251**	**0.380**	**0.345**	**0.504**	**0.272**	**0.568**	**0.349**
Fund based on ratios	**0.161**	**0.351**	**0.143**	**0.103**	**0.206**	**0.176**	**0.203**

Table 6: Final, overall priorities of the four countermeasures

6 Conclusion:

The earth is beset by multiple, interconnected challenges. Taken in a broader sense many of these are quality issues. It is as though quality management must start from scratch, with a new definition of what quality means. The tasks before the world are to identify, define and classify the challenges, and to generate multiple global countermeasures that hook on to the language of the market economy while pursuing a new direction. This paper shows one way in which the countermeasures can be prioritized. The numbers generated are purely illustrative, as the exercise has not been carried out by anyone with a claim to expertise in the field, though they are well meaning professionals from diverse fields, with a deep concern over environmental issues. The idea is to show a possible way.

This paper has focused on just four global countermeasures. There is no reason why a similar approach cannot be extended to national, provincial, urban or even neighbourhood levels. The tests we face need actions at every level, and involving everyone. The approach of using AHP can replace many a contentious debate with willingness and accord.

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Many commonly known facts or those easily obtained from the Net are not referenced