
Understanding Secrets of Sustainability through TRIZ Philosophy



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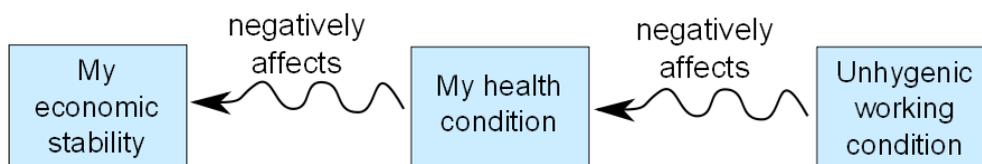
1. Introduction to Sustainability

The concept of “Sustainability” has become a very important issue during last two decades. Many scientists and researchers emphasize to incorporate sustainability measures everywhere including schools, colleges, business, occupation, trade, commerce, social development, urbanization, transportation, town planning and others. But what is sustainability and why is it so important?

Sustainability simply means the capability to sustain (or remain healthy and productive) within a diversified environment without harming each other. Sustainability is a complex function of economics, society, culture and ecology and extended into all branches of science, engineering and technology. This concept is applicable to anything whether it is a product or service or process or practice or structure or system or organization. A system or practice is often meaningless and sometime dangerous unless it is sustainable. But why does a system become unsustainable? What are the visible and hidden reasons behind un-sustainability?

2. Un-sustainability is caused by internal inconsistencies

Often humans (or organizations) give high importance to specific goals and achievements (say financial) and ignores many other important aspects (such as health, family, relationship, ecology, environment, peace of mind etc.). Suppose I am earning money by working in an unhygienic environment. Initially I may not realize the drawbacks of this practice but subsequently I get into health troubles and my earned money is spent in health care. As a result I not only loose my health but also loose my economic stability.

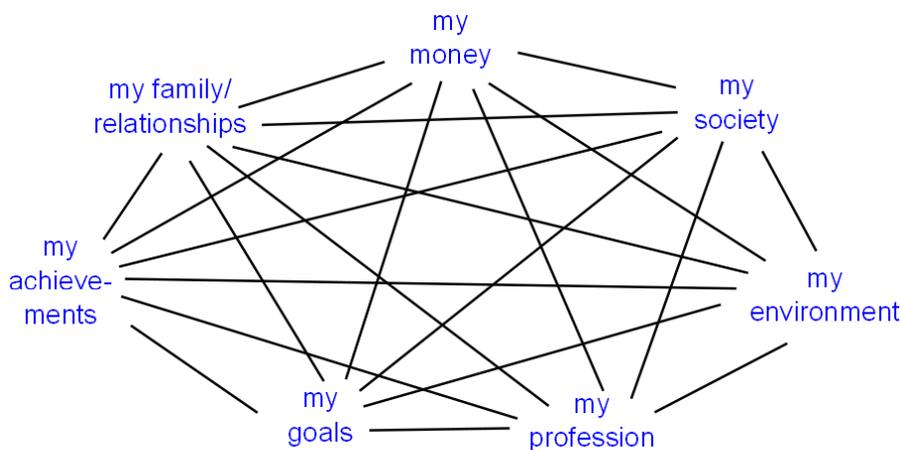


Cause and effect relationship

The above diagram shows how my economic stability is indirectly affected by my “unhygienic working condition”. If we analyze further we find that it is not only “unhygienic working condition” but there are many other factors like “bad habits”, “dependent family members”, “cheating habit of friends”, “accidents and natural disasters” etc. that can affect my economic stability.

The causes and effects are connected in chains. For example there may be many factors which affect my health which as a result affect my economic condition. Similarly there may be many factors which cause “accidents” or “family problem” or “something else” and thereby affect my economic condition.

Here we learn two things. First, improvement (or growth) in one aspect may be affected by improvement (or growth) in other aspects. Second, improvement (or growth) in one aspect is not enough. It is necessary to achieve improvement (or growth or stability) in multiple aspect simultaneously.

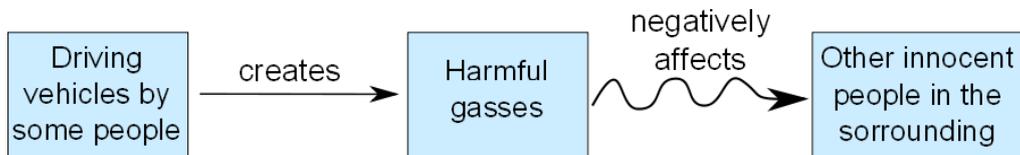


Inter relationship between various factors

Numerous factors like social, economic, cultural, technological, environmental etc. are inter-connected to each other. Although sometimes only a few factors become prominent and visible other factors still have their influence without our knowledge and attention. Problems in any of these factors can affect others sooner or later, directly or indirectly.

3. Broadening the issue- I am not alone in the society

Suppose I (or my family or my business or my country or similar) am rich, intelligent, good, strong, dynamic and capable of meeting all the needs whatever is required at any time. But what is seen as my capability is only apparent as I am living in the middle of various other systems. We may feel stronger by conquering science and technology and inventing faster cars or deadly weapons but the law of nature is different. Our harmful activities not only affect others but also to ourselves. For example, the carbon dioxide (or carbon monoxide or other harmful gases) produced by the vehicles and factories of a developed city pollute the air and affect all the people living in that environment. These situations are not sustainable.



Invisible causes of unsustainability

If we apply the TRIZ concept of Ideality to solve this problem, we may come up with solutions like either there should be no vehicle that emits such harmful gases (e.g. electrical cars) or there should be a mechanism (e.g., additional plantation/forestation) to neutralize such harmful effects.

Growth and development of one community or a few handful of people is not sustainable. A sustainable development should ensure development of every section of mankind, whether rich or poor, whether intelligent or bogus, whether dynamic or handicapped, whether expressive or silent.

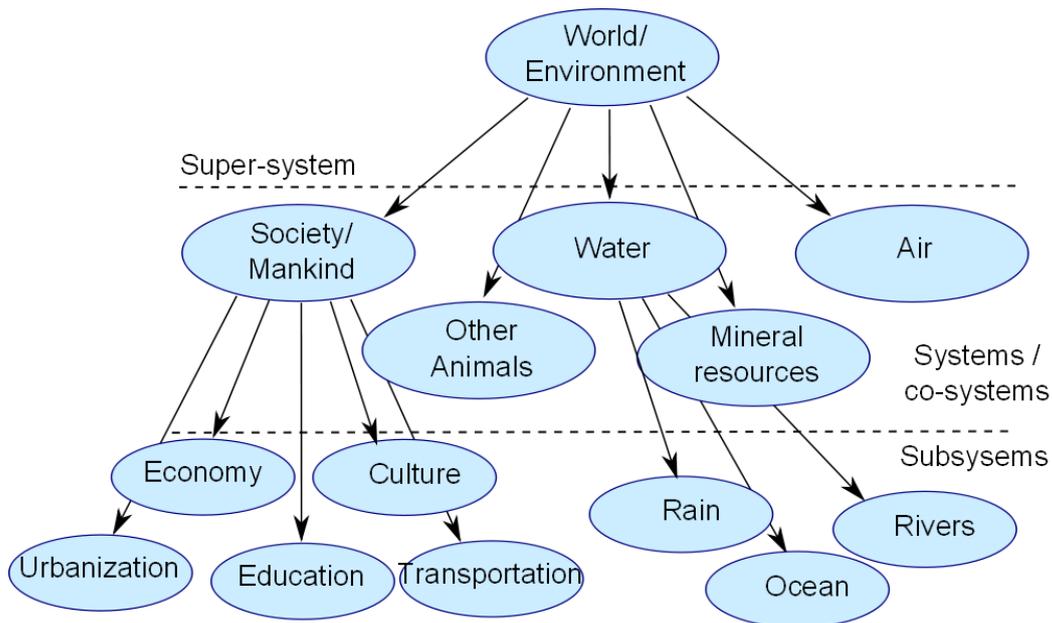
Citing a story from the history may be relevant. Ashoka, the king of Magadha, won the Kalinga war in 261 BC after killing more than 100,000 warriors of Kalinga and losing about the equal number of warriors from his own army¹. After the victory Ashoka saw only the dead bodies everywhere and there was nobody to rule over except few women and children. Ashoka realized his mistakes and followed Buddhism and non-violence. This story of the history gives us great lessons of sustainability.

There is no meaning of a King when there is nobody to rule over. There is no meaning of a business when there is no customer or the customer has no buying capacity. There is no value of money if the money cannot buy what is desired.

4. Human and Nature Relationship: Environmental Sustainability

According to TRIZ the whole world can be explained in terms of systems, sub-systems and super-system. The human society is a sub-system of "nature or creation" and has subsystems like education, culture, economy and so on. There are many other co-systems of human society, such as, water, air, rain, forests, mines, natural resources and even other animals.

¹ More about kalinga war in http://en.wikipedia.org/wiki/Kalinga_War



Supersystem, Subsystems and cosystems of Human Society

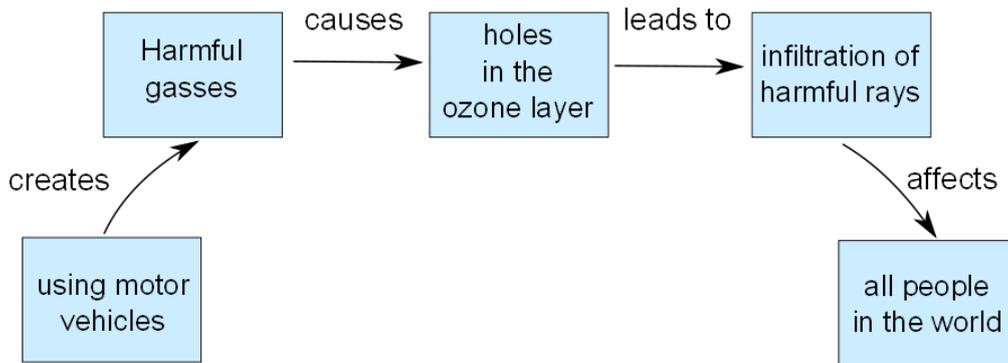
According to the TRIZ concept of systems, every system works together with its subsystems, co-systems and super-system. While introducing any change (or improvement) to any system we must ensure that the changes are not affecting adversely to the other systems around it. As we can mark in the above diagram there are a large number of systems around the system of “human society”. If any changes (or so-called improvements) introduced to its subsystems (like fast vehicles or large buildings) affects its co-systems (like water contamination, deforestation or over-consumption of natural resources) then that can lead to greater disasters (like global warming, climate change and natural calamities).

Affecting a subsystem may malfunction a system but affecting co-systems and super-system can malfunction several other systems leading to great unsustainability.

Everybody is running after development forgetting its long-term negative impacts. For example we cut the forests to build cities which causes holes in the ozone layer² and allows ultra-violet rays to pass through. Ultra-violet rays have dangerous effects on human health. Deforestation+--- also causes global warming and climate changes. Holes in the ozone layer or global warming do not affect only the people who built the cities rather affect the whole world including birds, animals and plants.

² More about ozone layer in http://en.wikipedia.org/wiki/Ozone_hole

Thus following the TRIZ concept of systems, the so-called economic development (say, using motor vehicles) not only affects the immediate environment (by polluting the air) but also affects other sub-systems (such as, people in other countries) and other co-systems (such as, birds, animals and other species).



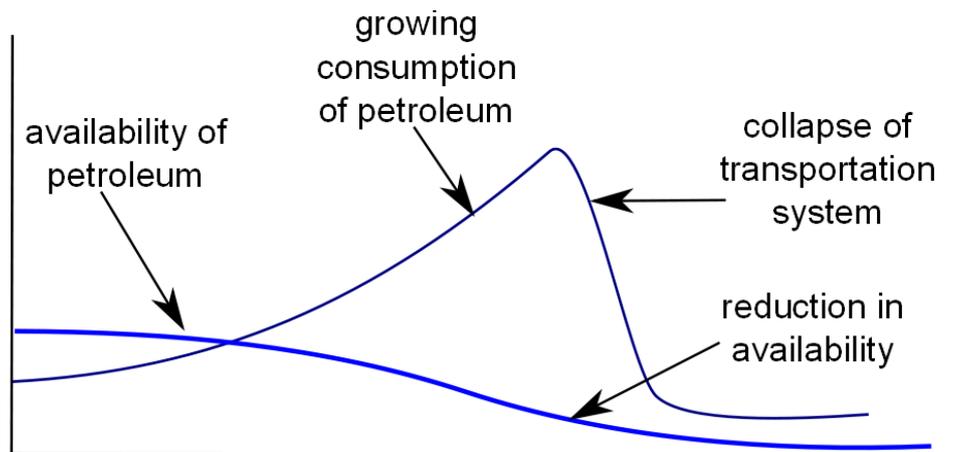
Negative effects of the transportation system

We have a great lesson here. All of us have direct relationships with earth and nature. Political boundaries may create hundreds of states and countries, but it has no impact on our relationship with earth and nature. Mistakes done by the people of one class or country also affects to the people of other classes and countries.

5. Over-consumption of natural resources

It is a fact that the natural resources are limited and cannot be produced artificially by human beings. But the steep growth of urbanization during last fifty years has led to serious over-consumption of many natural resources like forestland, ground water, oil and natural gas etc. Many cities in the world are suffering from shortage and contamination of ground water. Deforestation has led to global warming and climate change. Oil and natural gas may finish in next 20 years unless we put controls on the growth rate of their consumption.

During the consumption phase of natural resources we are attracted by its positive results and forget about the sustainability of this practice. This growth of urbanization is not sustainable. When there will be shortage of fossil fuel the current transportation system will collapse. When water and air will be polluted the health system will collapse. The whole system of urbanization will collapse because of shortage of various resources required for the cities to sustain. [The following graph shows how the transportation system will collapse when the availability of the petroleum will slowly reduce and finally finish on the earth.](#)



Collapse of transportation system due to over-consumption of petroleum

There are many instances where in the name of development we over-consume our natural resources which has a limited quantity on earth. We cut forests to build cities, suck out petroleum to run vehicles, burn coal to get electricity, drill thousands of holes to collect ground water and so on. **This trend of development is only temporary, partial and not sustainable**. We are not only finishing up valuable resources but also causing irrecoverable damage to our environment. According to the report of world commission on environment and development “Sustainable development implies meeting the needs of the present without compromising the ability of future generations to meet their own needs”³ The pattern and behavior of our consumption should have no negative effect on the nature.

One of the golden rules of sustainability is to spend only from our earnings and not from our capital. Spending from our capital can finish it up leading to bankruptcy. This rule works not only in finance but also in consuming our natural resources. Our consumption of natural resources should be so minimal that it should not deprive our future generations to consume the resources.

³ Report of the world commission on environment and development (Dec 11, 1987), retrieved from <http://www.un.org/documents/ga/res/42/ares42-187.htm>.

6. Contradiction of different systems in the world

Contradictions are situations where different goals try to fulfill at the cost of each other. According to TRIZ the changes or improvements in any system should not affect negatively to its adjacent systems. Conflicts with adjacent systems cause contradictions and make the system unsustainable. It is necessary to maintain a healthy balance between different systems in the world.

The world is a complex combination of various systems, biological, ecological, environmental, climatic and so on. Changes made to one system affect other systems and that in turn affect other systems through a chain of cause and effect relationship. For example, improvement in transportation system (say, running of more vehicles) will pollute the air (more smoke from vehicles). The transportation system is causing harm to its super-system which is not advisable. It is necessary to solve these contradictions in order to have long term and sustainable development.

- ⇒ It is desirable to have more vehicles for an improved transportation system (good). But more vehicles will consume more fossil fuel (bad). We want to run the vehicles but don't want to finish up our valuable natural resources (contradiction).
- ⇒ Currently urbanization is seen as a symbol of development. In the process of urbanization we construct roads, buildings and factories (good). But construction of more roads and buildings requires more land which requires cutting of forests. Deforestation causes global warming and climate change (bad). We want roads and buildings but we don't want deforestation (contradiction).
- ⇒ We want to live in safe environments undisturbed by pests, insects and wild animals (good). But we use a lot of pesticides on crops and domestic environments which has negative effects on many harmless and helpful creatures too (bad). In some cases the humans drive away the wild animals and in some cases the animals move away out of fear. This causes danger to many wild animals and rare species and lead to ecological imbalance (bad). We want to live safe but don't want to extinguish the endangered species (contradiction).
- ⇒ Development requires industrialization (good). The wastes and byproducts of industries pollute the environment and atmosphere (bad). We want to have industries but don't want the industries to pollute the atmosphere (contradiction).
- ⇒ We need development (good). But the so-called development involves many anti-environmental habits and occupations. Oil extraction finishes our natural resources, vehicle driving pollutes our air, over-fishing in coastal areas reduces fish population (bad). We want township, transportation and income generation but don't want to spoil natural resources and environment (contradiction).

It is not easy to solve the above contradictions. For example if we reduce our oil extraction drastically then our transportation system will collapse. Cars and aeroplanes will be useless and half of our activities will be ceased. There is continuous effort to find innovative methods to solve these contradictions. We will discuss about the solutions in a separate article.

7. TRIZ concept of ideality and total sustainability

According to the TRIZ concept of ideality, “the ideal state of the system is where all its functions are achieved without causing any problem. The system is better, faster, low cost, low error, low maintenance and so on. In other words, an ideal system consists of all positives and no negatives”⁴. The “Ideal Final Result” is the ultimate solution of any problem. “The solution generally requires no space, no time, no hard labor, no investment and no maintenance. In other words, the IFR delivers all benefits and no harm”. The concept of Ideality is applied in various fields to arrive at Ideal Product, Ideal Process, Ideal Technique and Ideal Result etc.

The concept of Total Sustainability also denotes the same. A totally sustainable system (or process or business or practice or development) is that which has all desirable benefits and no negative side effects. The system or process consumes minimum resources and has no negative side effects. Total sustainability management targets at reducing consumption of valuable resources and removing harmful side effects.

Thus the concept of sustainability is nothing but application of ideality from social, economic and environmental perspective. A sustainable development is continuous and indefinite delivery of welfare through meeting of all types of needs. A sustainable business or organization has to recognize its social and environmental obligations in order to neutralize its negative effects.

The big similarity between Ideality and sustainability is that (i) both of them guide us to prepare for the future requirements, crisis and hazards (ii) both of them are not possible to achieve completely. In most cases ideality or sustainability can be achieved only partially. (iii) both of them teach us to predict the unpredictable future and to prepare for the future uncertainties, (iv) sustainability is nothing but application of ideality in specific multiple aspects. A sustainable system is ideal and an ideal system is sustainable.

⁴ Umakant Mishra, Introduction to the Concept of Ideality in TRIZ, <http://papers.ssrn.com/abstract=2273178>

Apparent differences between Ideality and sustainability

If we analyze the literatures on both of these theories we find that “Ideality” gives more importance on achieving the main useful functions (MUF) and eliminating main harmful functions while “Sustainability” seems to be giving more importance on eliminating long-term negative effects. But it may be a limited perception of the author. Conceptually both of them try to achieve all positive effects and eliminate all negative effects.

The TRIZ concept of ideality has been applied more on engineering and technology to build advanced products and systems to meet the needs of future generation. On the other hand the concept of sustainability is being applied more on the processes like business, urbanization, social development, natural resource management etc. However both the concepts essentially target at the same thing and there is no reason why one should be applied in one field and not on the other.

The concept of sustainability sounds limited when some practitioners limit it to one or two aspects like people, or society, or green, or nature, or natural resources etc. While there is no harm in implementing sustainability in one or two aspects in the beginning, it should be broad to include other aspects like science, technology, engineering, management, governance, politics and many more.

8. Conclusion

Man is the most intelligent creation of God. Man learns from every mistake and its knowledge matures on every day. After creating the weapons that can destroy the world, the next challenge of man is not to win an enemy but to survive the disasters. The intelligence of the modern man understands that the worst challenges to face in future are the manmade disasters. It is therefore important to control our own behavior to minimize its negative effects on other systems and environment.

Systems or practices become unsustainable because of internal conflicts or contradictions. Sometimes gain to one group of people causes loss to another group of people (say, by unfair trading). Improvement in transportation (say, running of vehicles) pollutes air and environment. Growth of urbanization causes deforestation and global warming. It is necessary to overcome these contradictions to achieve sustainability.

The concept of sustainability is very similar to TRIZ concept of Ideality. An ideal or sustainable system should have all the desired (positive) features and no harmful (negative) features. A sustainable system is ideal and an ideal system is sustainable. Both the concepts can be applied to anything, such as, a product, a process, a practice, a structure, a system or an organization.

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About the author

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Umakant is a Master in Philosophy (MA), Master in Business Administration (MBA), Bachelor in Law and Logic (LLB), Microsoft Certified Systems Engineer (MCSE+I), Certified Novel Engineer (CNE), Master Certified Novell Engineer (MCNE), Certified Intranet Manager (CIM), Certified Internet Professional (CIP), Certified Software Test Manager (CSTM) and holds many other global IT certifications.

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