



Environmental Sustainability Maintenance

DR. DHIRENDRA KUMAR SINGH

Associate Professor, Dept. of Agricultural Biochemistry, B.B.D. Govt. College, Chimanpura, Shahpura, Jaipur, Rajasthan, India

ABSTRACT: When it comes to sustainability, most of the focus has been on new buildings, but now the attention is starting to shift to how businesses can maintain their existing assets more sustainably. You can apply environmentally friendly practices to all the tasks involved in maintaining your assets and buildings. But sustainable maintenance is more than that. It's also focused on eliminating wasteful practices, lowering your costs, and reducing the social impact of your actions. With that in mind, here are some of the basics of sustainable maintenance along with the main principles to guide you. There are many approaches people can take to transition to environmental sustainability. These include maintaining ecosystem services, reducing food waste, and promoting dietary shifts towards plant-based foods. Another is reducing population growth by cutting fertility rates. Others are promoting new green technologies, and adopting renewable energy sources while phasing out subsidies to fossil fuels.^[13] The United Nations agreed the Sustainable Development Goals (SDGs) in 2015.^[14] These set a global agenda for sustainable development, with a deadline of 2030. One option to overcome barriers to sustainable development is to decouple economic growth from environmental conservation.^[9] This means using fewer resources per unit of output even while growing the economy.^[15] This reduces the environmental impact of economic growth such as pollution. Doing this is difficult. Some experts say there is no evidence that it is happening at the required scale. Global issues are difficult to tackle as they need global solutions. Existing global organizations such as the UN and WTO are inefficient in enforcing current global regulations. One reason for this is the lack of suitable sanctioning mechanisms. Governments are not the only sources of action for sustainability. Business groups have tried to integrate ecological concerns with economic activity.^{[16][17]} Religious leaders have stressed the need for caring for nature and environmental stability. Individuals can also live in a more sustainable way.^[5] The concept of sustainability has faced various criticisms. One is that the concept is vague and only a buzzword.^[1] Another is that sustainability might be an impossible goal.^[18] Some experts have pointed out that "no country is delivering what its citizens need without transgressing the biophysical planetary boundaries".

KEYWORDS: environmental, sustainability, maintenance, human beings, resources, principles, low cost

I. INTRODUCTION

Maintenance is all about keeping your equipment and assets in use for longer. However, many maintenance tasks also require the use of materials and energy which can produce unintended and hazardous byproducts (such as dust or emissions) that have a detrimental impact on the environment. To implement sustainable maintenance, you must look at the impact of the maintenance required to prolong an asset's life cycle from an environmental point of view. You must consider the environmental implications of specific maintenance activities and then compare them to the impact of alternative solutions, such as replacing the asset or switching from a preventive to a reactive maintenance strategy.

The main aspects you should consider when evaluating the sustainability of your maintenance tasks are the:

- Maintenance cycle and how the impact of a maintenance task grows the more you repeat it.
- Impact of the activity in terms of the amount of energy you use, the pollutants it creates, and the hazardousness of the waste.
- Impact of the maintenance products you use (such as solvents and grease) on the environment.¹

Once you have an idea of the impact of a specific maintenance activity over the life cycle of an asset, you can then compare it to alternative actions and think about how you can improve it. The main objective of sustainable maintenance is to reduce your impact on the environment while eliminating waste. But when maintenance and efficiency go together, you can enhance the performance of your business environmentally², socially, and economically. Environmentally, sustainable



maintenance can help you reduce emissions, improve air quality, and reduce waste. You can also prolong asset lifespans and reduce energy costs. As an example, preventive maintenance can help you reduce raw material usage by 20% and cut vehicle emissions by 30%. Sustainable maintenance also has important social benefits. It can improve the health and safety of your workers and reduce the impact of your business³(noise and pollution) on the local community. There are also economic benefits associated with sustainable maintenance, as it can help you increase compliance, improve utilization rates, prevent unnecessary maintenance, and reduce the costs associated with fines, downtime, and breakdowns.⁴ The first step in creating a more sustainable maintenance function is to achieve buy-in from the wider team and to explain why you are making changes. Some of your team will actively participate in the changes while others may only respond once they see others acting responsibly. Once you have explained the reasons for the changes, you can then look critically at how you perform maintenance tasks and start to make improvements.⁵

Prevent unnecessary use

One of the first things to consider is whether maintenance of a particular asset is necessary at all. If it is, then think about how you can reduce the frequency of maintenance tasks without suffering any notable downturn in performance. You should also ask yourself whether you can carry out the maintenance task in a more efficient way that reduces the environmental impact and the frequency of future maintenance.⁶

Use reusable resources

Where possible, you should also make sure that the resources and materials that you use for maintenance tasks are renewable/reusable. For example, is it possible to use sustainable energy sources for tasks that require electricity? Perhaps you can use human power rather than machine power for certain activities without impacting efficiency? And make sure that you either reuse any waste produced by the maintenance work or recycle it properly.⁷

Use limited resources wisely

Sometimes there's no alternative to using finite resources but you can still do so in a considered and sustainable way. For example, can you perform a task more efficiently to reduce the amount of electricity or materials you use? Or perhaps you can use equipment that consumes less energy or materials that reduce the impact on the environment, such as water-based paints rather than oil-based or solvent-based alternatives⁸

II.DISCUSSION

Implementing sustainable maintenance does not have to be difficult, innovative, or time-consuming. There are some simple and cost-effective changes that you can make to your business right now. As an example, the installation of low-flow toilets and sink sensors is a simple way to reduce water waste. You can also reduce electricity usage by 75% by switching from incandescent light bulbs to compact fluorescent lights. You can then install sensors in hallways and other less-used areas of the business to turn your new lights off when they're not in use.⁹ Another simple step that you can take is to create and use an efficient recycling plan. Providing appropriate containers and taking the time to explain to techs and workers what can be recycled and how they can help to keep more of your waste out of the landfill. Technology can help you make the switch to more sustainable maintenance tasks. Hippo CMMS® enables you to track, schedule, and organize all your maintenance activities and keep track of what's working and what's not so you can identify trends and find areas for improvement.¹⁰ As well as making your operations run smoother, Hippo CMMS can also help you go green. Optimizing your preventive maintenance allows you to keep buildings and assets operating at peak efficiency, while the mobile app puts the power in your techs' pockets so you can go paper free. There's also intelligent spare parts management so you can reduce the number of deliveries (and the carbon impact), while automation with IoT helps you create greener buildings that use less energy and save you money.¹¹ Sustainable maintenance is important because it enables you to enhance the performance of your business environmentally, socially, and economically. Environmentally, sustainable maintenance helps you reduce emissions and reduce waste. Socially, it can improve the health and safety of your workers, while economically, you can improve utilization rates and reduce the costs associated with breakdowns and fines.¹² To implement sustainable maintenance, you must consider the environmental implications of specific maintenance activities. You can then compare



them to the impact of alternative solutions, such as replacing the asset or switching from a preventive to a reactive maintenance strategy.¹³

The environmental dimension is central to the overall concept of sustainability. People became more and more aware of environmental pollution in the 1960s and 1970s.¹⁴ This led to discussions of sustainability and sustainable development. This process began in the 1970s with concern for environmental issues. These included natural ecosystems or natural resources and human environment.¹⁵ It later extended to all systems that support life on Earth, including human society.¹⁸ Reducing these negative impacts on the environment would improve environmental sustainability. Environmental pollution is not a new phenomenon. But it has been only a local or regional concern for most of human history. Awareness of global environmental issues increased in the 20th century.^{[42]:5[43]} The harmful effects and global spread of pesticides like DDT came under scrutiny in the 1960s.^[44] In the 1970s it emerged that chlorofluorocarbons (CFCs) were depleting the ozone layer.¹⁶ This led to the de facto ban of CFCs with the Montreal Protocol in 1987. In the early 20th century Arrhenius discussed the effect of greenhouse gases on the climate. (See also history of climate change science).^[45] Climate change due to human activity became an academic and political topic several decades later. This led to the establishment of the IPCC in 1988 and the UNFCCC in 1992. In 1972, the UN Conference on the Human Environment took place. It was the first UN conference on environmental issues.¹⁷ It stated it was important to protect and improve the human environment.^{[46]:3} It emphasized the need to protect wildlife and natural habitats. The natural resources of the earth, including the air, water, land, flora and fauna and [...] natural ecosystems must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.¹⁹

In 2000, the UN launched eight Millennium Development Goals. The aim was for the global community to achieve them by 2015. Goal 7 was to "ensure environmental sustainability". But this goal did not mention the concepts of social or economic sustainability.^[1] Specific problems often dominate public discussion of the environmental dimension of sustainability:²³ In the 21st century these problems have included climate change, biodiversity and pollution. Other global problems are loss of ecosystem services, land degradation, environmental impacts of animal agriculture and air and water pollution, including marine plastic pollution and ocean acidification.²⁰ Many people worry about human impacts on the environment. These include impacts on the atmosphere, land, and water resources. Human activities now have an impact on Earth's geology and ecosystems. This led Paul Crutzen to call the current geological epoch the Anthropocene.²¹ For example, the impact of human activity on ecosystems can reach tipping points in the climate system.²²

III.RESULTS

There are several methods to measure or describe human impacts on Earth. They include the ecological footprint, ecological debt, carrying capacity, and sustainable yield. The idea of planetary boundaries is that there are limits to the carrying capacity of the Earth. We should not cross these thresholds to prevent irreversible harm to the Earth.²⁴ These planetary boundaries involve several environmental issues. These include climate change and biodiversity loss. They also include types of pollution. These are biogeochemical (nitrogen and phosphorus), ocean acidification, land use, freshwater, ozone depletion, atmospheric aerosols, and chemical pollution²⁵ (Since 2015 some experts refer to biodiversity loss as change in biosphere integrity. They refer to chemical pollution as introduction of novel entities.)²⁶

The IPAT formula measures the environmental impact of humans. It emerged in the 1970s. It states this impact is proportional to human population, affluence and technology.^[27] This implies various ways to increase environmental sustainability. One would be human population control. Another would be to reduce consumption and affluence^[84] such as energy consumption. Another would be to develop innovative or green technologies such as renewable energy. In other words, there are two broad aims. The first would be to have fewer consumers. The second would be to have less environmental footprint per consumer.²⁸

The Millennium Ecosystem Assessment from 2005 measured 24 ecosystem services. It concluded that only four have improved over the last 50 years. It found 15 are in serious decline and five are in a precarious condition.²⁹

"Everything that we need for our survival and well-being depends either directly or indirectly on our natural environment. Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, [conditions] that permit fulfilling the social, economic and other requirements of present and future



generations.” Sustainability is not just about renewable energy and energy efficiency. Realizing true sustainability requires an understanding of the connections between the environment, society and the economy. We must strive to achieve a sustainability state of mind that permeates all aspects of our day-to-day lives in local, national, and international domains.³⁰

A popular method of considering the sustainability state of mind is the triple bottom line approach. The three bottom lines, or pillars, are:

1) Environmental Sustainability

Our most basic requirements: unpolluted air, clean water and fresh food, all come from our environment, as does the energy and raw materials we need for construction and transportation.³¹ Environmental sustainability is essential if we wish to have and continue to have the resources to meet our needs. In the broadest sense of the definition, environmental sustainability involves the entire global ecosystem (oceans, freshwater systems, land and atmosphere). However, environmental sustainability principles can equally be applied to ecosystems of any size, even down to the scale of a small home garden.³²

2) Social Sustainability

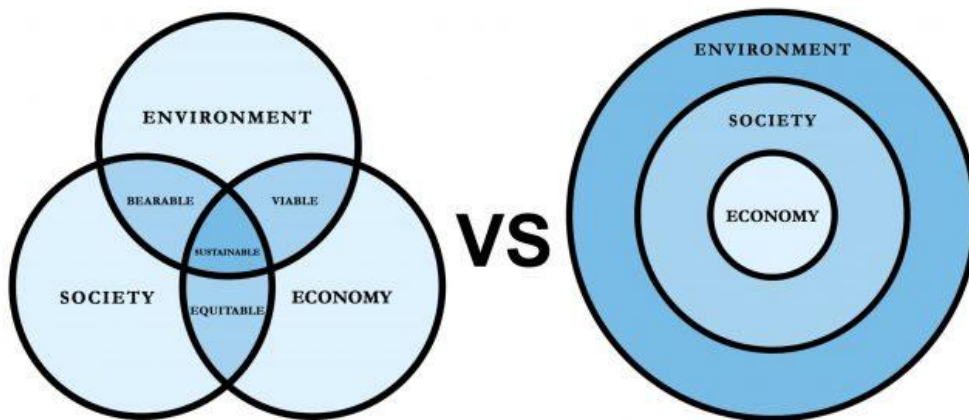
A socially sustainable society is one in which all members have equal rights, all share equitably in societal benefits, and all participate equally in the decision-making process. Additionally, a society is unsustainable if it consumes resources faster than they can be renewed naturally, discharges more waste than natural systems can assimilate without degrading, or depends upon distant sources for its most basic requirements. As with environmental sustainability,³³ social sustainability principles can be applied to societies of any size. For example, one of sustainability’s grand challenges is to simultaneously reduce consumption in the developed world while raising the standard of living of the developing world – we need to be responsible global citizens by making informed choices every day within our homes and communities.³⁴

3) Economic Sustainability

Economic sustainability is about much more than the sustained growth of resources and profit margins. Economic sustainability takes into account the social and ecological consequences of economic activity. We need to carefully consider the full life-cycle of our goods, from extraction of raw materials, through processing, manufacture, distribution, use, maintenance, repair, and eventual recycling or disposal.³⁵

A common method of visualizing the pillars of sustainability is a Venn diagram, with each circle representing one of the three primary pillars. However, a more-accurate depiction of sustainability is achieved by using concentric circles to symbolize the pillars, with the most important aspect, the Environment, represented by the outer circle.³⁶

The Environment is of primary importance because a healthy ecosystem is required to nourish a robust society. Consequently, Society and Social Responsibility are of secondary importance. Economic Sustainability is third because a prosperous Economy cannot exist without a healthy and just society.³⁷



In reality there are many pillars required to support true global sustainability. Some of these include: the Institutional Capacity for systemic change; the Organizational Capacity for enacting change whilst preserving cultural values; and our own Personal Values – do we possess the moral intelligence to recognize when things are unsustainable and also have the resolve to change them³⁸

IV.CONCLUSION

For many people, however, progress is about much broader human aspirations. It might be addressing global problems such as the environment, social justice and human suffering, through sustainable food supplies, water, medicine or renewable energy. Here, technology is a tool at the service of humanity rather than the engine of macroeconomic ambitions.³⁹ Its advances must redress stark global inequities, and be balanced by the care for our fellow humans and a fragile environment. Others understand progress personally, choosing whatever technologies they wish to use to improve their own quality of life.⁴¹ Religious belief systems interpret progress vis-à-vis God-given limits, and the effects of technology on the spiritual and social health of people and communities or the non-human environment. By contrast, transhumanism believes in a future vision, which some consider to be quasi-religious, where technology extends individual human capacities without limit.⁴⁰

These illustrations show the diversity of viewpoints found in contemporary societies. Yet, in a global context, there is concern that certain views of the world gradually become all pervasive, alongside the spread of technology or theories of economics. When technologies are introduced to relatively isolated cultures with different value systems, they are often accompanied by a package of implicit foreign values about modernity and the dominant Western economic system. Such cultures might respond in four different ways.⁴²

The first response, capitulation, is to depart from traditional culture and to accept what is offered. However, this might lock the culture into new dependences on the incomers, their supplies and agendas.⁴³ The opposite response, retrenchment, is to hope to keep the invasion of alien practices and values at bay by re-affirming one's own. However, this carries the risk of intolerant fundamentalism or the inability to withstand the force of Western technology, economics and practices. Between these two poles lies the third response, accommodation, which is to accept some things while resisting others. Again, this is hard to sustain because poorer countries are unequal players in a global market, the rules of which are written primarily for others. According to international trade rules, the removal of trade 'barriers' asserts a monopoly over all other values, whether religious, ethical or cultural.⁴⁴ For example, these rules effectively impose Western intellectual property rights over subtle concepts of community ownership in traditional cultures. The fourth response, for a few more-powerful developing countries, is to become a strong enough global player to adapt the system of modernity to their own values.⁴⁵



This globalized modernity is disturbing because the accompanying values are manifestly flawed, especially when it comes to environmental sustainability. In this regard, we can identify four basic attitudes to nature and human intervention⁴⁶ At one extreme is an attitude towards nature best described as 'ownership'. Nature is an object for humans to use, exploit and dispose of exactly as we wish. We 'found' it, staked our claim and now we feel that we can do whatever we want to do with it. Whatever is good for humans is good. This is a model of complete anthropocentricity, with humans as subject and nature as object. If our experience of nature leads us to see it as a threat, it is to be conquered; its unruly forces are to be tamed and harnessed for humanity. The Genesis text, "to subdue the earth", has been separated from its counterbalancing idea of "caring for the garden". This instrumental, reductionist and unrestrained view is a primary philosophical root-cause of the current environmental crises. It has origins both in medieval scholastic theology and Enlightenment humanism, and is compounded by economic reductionism and old-fashioned human greed and carelessness.⁴⁷

At the other end of the spectrum is the second extreme attitude, an eco-centric view in which nature is to be revered as sacred or even divine. This view emphasizes the relatedness of all things, among which humans are merely one part and not the centre or the summit. We should, therefore, hardly intervene in nature, lest we interfere with and upset the order and relationships throughout the natural world, which are part of a divine wisdom in a pantheistic, rather than a monotheistic, sense. Eco-centrism often embraces the idea of Gaia, seeing the Earth as a self-sustaining interdependent organism; 'Mother Nature' is assumed to know best. This 'deep ecology' tradition reacts against the exploitation expressed by the ownership model, and seeks to recover a sense of the sacredness of the Earth and its creatures, seasons and varied phenomena, which western Christianity, modern science and the European Enlightenment have 'desacralized'. It has a tendency to equate natural with good, and to equate human intervention through technology with spoiling, except where it is done in deep harmony with nature, without disturbing her balance and concord.⁴⁸

These two models illustrate the two poles of a spectrum of attitudes. In practice, most people hold a less extreme position, but are usually inclined one way or the other. Therefore, the third and fourth basic attitudes, which are modulated versions of the first and second, can be described as follows: partnership, which represents a more moderate view of the eco-centric model; and maintenance engineer, which is a more pragmatic version of ownership.⁴⁹

Partnership with nature acknowledges reluctant use. Nature has intrinsic value for its own sake, but it is not untouchable. A deep sense of respect means that any changes that we make must not upset the overall balance. It is a relationship of equals, not of higher to lower. This is the typical perspective of the environmental movements of industrialized countries, the roots of which include the European Romantic tradition, reactions against the mastery over nature of the Enlightenment and the American wilderness movement, which is associated with the naturalist John Muir (1838–1914) and the Sierra Club. Nature is a source of inspiration rather than of worship, but its fragile beauty and balance must not to be diminished by either callousness or carelessness.⁵⁰

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