Clean Technologies and Environmental Policy (2023) 25:1–2
https://doi.org/10.1007/s10098-022-02447-2

EDITORIAL

A reflection based on personal experience and observation on the growth of the idea of sustainability

Subhas Sikdar[1]

Published online: 1 December 2022

With this issue, we begin the 25th year of continuous publication of this international journal—which is no doubt a significant milestone. This augurs personal satisfaction as I have been a founder of this journal and serve as the editor-in-chief. Over the years this journal has increased its visibility among professionals interested in clean technologies and associated policy implications, as evidenced by huge increases in submissions of manuscripts. Despite steady increase in submissions over the years, we decided not to increase the number of issues per year, which still is ten issues. This required that we sustain a large initial rejection rate to maintain high scientific standards. We editors of this journal collectively look forward to more success and continued publications for years to come.

Twenty-five years ago, at the time of the founding of this journal, terms such as sustainability, sustainable development, and sustainable technologies were rarely used in scientific and, specifically, technological publications. The journals on environmental economics, and books and reports on sustainable development were around already but their focus was on sociopolitical realms. We started encouraging the inclusion of sustainability in technical innovation of processes and products shortly after launching the journal. Our focus from the very beginning was to uphold a scientific approach to sustainability. Environmentally cleaner technologies in those days were anchored on ideas such as waste minimization, pollution prevention, design for the environment, and industrial ecology. The procession of these ideas ultimately culminated in sustainable development. Green chemistry came along to be established as a superior synthesis approach to standard chemistry, much to the chagrin of established chemists who questioned the very idea of green chemistry and asked if they themselves were practicing "brown chemistry." These monikers of research approaches gained acceptance in academic circles when funding programs were created to support research in these areas. In practice, however, these approaches were not much different from the original idea of waste minimization. These funding programs have had a very powerful effect on normalizing these evolving ideas over time, as one would expect. Circular economy, the latest entry provided a new luster. With government funding in all countries, this idea too has been established as an accepted approach to sustainability. Normative scientific ideas of what constitute sustainability, and how one proceeds on scientific methods to achieve and validate it, have also evolved over the last 25 to 30 years.

While sociopolitical view on sustainability remained cloudy, it still gained currency. In the scientific and technological fields, however, definition of sustainability should not remain inexact. Theoretical approaches to an understanding of sustainability naturally started in thermodynamics. Attempts have been made to use entropy or exergy as a measure. These highly mathematical attempts have achieved very limited advancement in practical understanding. A recent paper[1] acknowledges the limitation of only using thermodynamic variables but hopes that a follow-up assessment using non-thermodynamic variables can be used to achieve a truer theoretical understanding of sustainability. In practical terms the uncertainty of what sustainability is, and how one knows when one achieves it remains largely ignored in research. All relevant technological journals, including this one, routinely publish papers with assertions of sustainability and green approaches in their titles without providing evidence in support of the assertions. This is unfortunate. My personal experience with dealing with scientific sustainability spans the entire gamut of these past twenty-five years. The important aspect of measuring sustainability as continual improvement had been largely missing. I wrote a book[2] in the recent past dealing with this issue and emphasized that all these touted approaches correctly deal with relative, not

✉ Subhas Sikdar
subhas.sikdar@gmail.com

1 Cincinnati, OH, USA

1 Sciubba, E. A thermodynamic measure of sustainability, Frontiers in Sustainability, vol 2, article 739,395, Dec 2021.

2 Measuring Progress towards sustainability: a treatise for engineers, Sikdar SK, Sengupta D, and Mukherjee, R., Springer International, Switzerland, 2017.

absolute, sustainability, which leaves the idea of continual improvement alive. In this book we reviewed the past work on quantitative measures of sustainability and summarized our own technical work on measurement. Measuring relative sustainability is of utmost importance in establishing one's contribution on a firm footing. Some contributions did use the comparative approach, but the sustainability metrics or indicators used were almost never exhaustive. Given indicator data, we have so far been able to opine if a specific process or product is better than another from sustainability viewpoint. This is retroactive assessment. What is needed is to be able to evaluate a prospective process at design stage that will be better than any existing process or product. My personal view is that we have so far failed to make sustainability quantitative, even though mathematical methods have been universally used. It is also my view that it is perhaps sufficient to look upon sustainability as a state that is not out of sight but is out of reach. Continual improvement in technologies will allow us to travel closer to the desired state over time.

Perhaps the most disappointing feature in publications about sustainability these days is aggressive use of carbon emissions (as CO_2 mostly, sometimes additionally CH_4) as the sole criterion for the measure of sustainability. This is clearly wrong because anthropogenic activities potentially produce a host of pollutants that are harmful to human health and the environment. It needs to be understood that carbon dioxide is not a pollutant, though it is legally treated as such. In the USA, the Supreme Court, in a landmark legal decision, stated that carbon dioxide emission may be regulated by the Environmental Protection Agency under the Clean Air Act. At issue was that an "endangerment decision" on CO_2 emissions was promulgated by the Agency, which was challenged in the court. The Supreme Court decision was a reaction to this challenge. Thus, CO_2 legally became pollutant subject to regulatory actions. The US decision to use legal means followed a decade-old effort by the United Nations Environment Program to get the member states to limit this emission to arrest global warming. The first attempt was the Kyoto Protocol in 1997, and later several Conferences of the Parties (COP) were held. Control of CO_2 globally clearly lies in the political arena, and its success or failure depends on global cooperation. The struggle to limit atmospheric carbon dioxide to a predetermined value is a separate matter. It should not be used as the sole measure for deciding whether a technology is sustainable or not.

Subhas Sikdar
Editor-in-Chief