GLOBAL SCIENCE

David Rooney
University of Queensland, Brisbane, Australia

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Summary

Organizing scientific knowledge in a sustainable way is possible if the lessons of history are taken. China, Islam, and India have all had prodigious scientific capacities in the past. While those bodies of knowledge have withered for various reasons, it is unreasonable to suggest that it was because they had nothing important to offer (see The Grand Patterns of Change and the Future). It is equally unreasonable to suggest that even if that knowledge was beneficial that it was in all cases not as beneficial as the new science of the West. The reasons for the withering of that knowledge are not all of a technical nature. We will see that science is a cultural artifact, and that the growing hegemony of Western science has to a large degree grown as part of the growing cultural hegemony of the West. The choice of using Western scientific knowledge is, therefore, not just a choice made on the grounds of the efficacy of that knowledge. Science and imperialism (in the same vein as Christianity and imperialism) have clearly followed the trajectory of the post-Columbian European expansion. The argument put forward here is not one of decrying the value of Western science at the altar of a romanticized local science. Western science is not decried and local science is not romanticized. The simple point is that both are needed but that in the interests of good risk management the hegemonic science must not be allowed to swamp the local. This implies that we have something new rather than a repeat of the past where the two streams of science develop without being in dialogue with each other.

If we are to achieve global science and sustainability, knowledge about the world must be connected to the cultural and historical context of the location of the problems involved. Despite the power of Western science, its tendency to generalize and to reductionism place limitations on what it can achieve. These limitations can be significantly lessened if that knowledge is connected to local conditions. This provides

the needed specificity and perspective that can overcome serious failure in Western science such as those during the Green Revolution. We need to be able to move beyond seeing knowledge, technique, and technology as implantable solutions. We must escape the wrong perception of Western science as the producer of hard, unambiguous truths that are immune from myth, romanticism, and ambiguity. Western science can certainly provide powerful help but we need to connect to social systems, spiritual systems, ecological systems, and so on if true sustainability is to be assisted by science.

1. Introduction

The history of science tells us that science is a double-edged sword. It has, for example, provided us with the ability to cause great harm, through the use of nuclear bombs, and the effects of acid rain, global warming, napalm and so on. On the other hand, science has also allowed us to have the Green Revolution, to perform life-saving operations on unborn babies, to satisfy our curiosity by peering into the distant reaches of the universe, and to cure diseases like smallpox. However, the kind of science we are thinking about here is only one kind of science, Western, positive, experimental science. Yet other kinds of science are important to the sustainability of the world's social and ecological systems. In this entry, consideration is made of how we might better enhance sustainability using Western and other science. An examination will be made of how we might reorganize our use of science to help avoid the causes of serious sustainability problems and ameliorate those that already exist through an under-appreciation of other science. The lessons of history suggest that a science risk management strategy that involves both Western and other sciences is advisable.

2. The Lessons of History

The history of science reveals that China, India, and Islam had great scientific capacities in various times in history. Furthermore, there are still non-Western local sciences that have much to offer including those of Aboriginal, Inuit, and other indigenous cultures. The knowledge that is held in these local sciences and in the traditional science of China, India, and Islam is a considerable body of knowledge that has been developing over millennia. Moreover, recognition must be made of the fact that much of this knowledge has worked very well in the context of the local circumstances from which they have emerged. Having made this statement, it is not to be construed as suggesting that Western science has nothing to offer at the local level where sustainability issues are being worked through. On the contrary, the abstract, reductionist, generalizing in Western science affords the ability to quickly create new knowledge and respond to changing global conditions. However, the necessary level of specificity of this knowledge to the conditions at the local level is often missing. It seems only common sense that it is as well to value specificity as much as generalizability, particularly when one is very often concerned with solving local problems. Indeed, the very essence of sustainability is to be found in acting locally with a view to the global. At present there is a great lack of sensible balance between the specific and the general. The balance is tipped quite discernibly to the generalizing science.

To exemplify the necessity for the balancing of specificity and generalizability we can look for cases in the Green Revolution. The Green Revolution was launched as a

Western scientific rescue of the developing world's inability to feed itself. However, the application of this science was often found wanting when it generalized about the kinds of technology and techniques that were needed to improve crop yields but in doing so had ignored local knowledge. One such example is to be found in Indonesia where the introduction of new high yield rice varieties that needed chemical fertilizers and pesticides actually brought about plagues of pests and reduced yields. As a result, more pesticide needed to be used than previously and that brought with it increased residues in the food chain. Eventually, the pesticides and fertilizers had to be banned and ecologically based methods of pest control (derived from local science), which kept the insect populations in balance (rather than eliminating them), were used in conjunction with the reintroduction of locally appropriate rice strains. The later acknowledgment of this local knowledge was the key to the eventual success of many of the various measures taken on behalf of the Green Revolution. Indeed, this kind of situation can be seen as setting a trend in which, for example, the ecological sciences began to change their methodologies so that they could better understand local variation.

In this entry, we want also to examine the possibility for the management of science and sustainability at a global level. However, this is an attempt to explore the possibility of a truly global science system that includes the sciences of East and West, North and South, the general and the local.

2.1. A Brief Cultural History of Western Science

Before moving too far forward in this argument, it is necessary to further our understanding by unpacking some of the characteristics of Western science. Western science can be described as a system of reasoned, empirical, and theoretical enquiry. Science can also be characterized as being about understanding (often in the abstract) and as being linked to the development of technology. However, although this science is about reasoned knowledge and empirical and theoretical enquiry, this does not mean that it is the producer of ultimate truth and objectivity. Science is not an enterprise free from untruth and myth. Indeed, Western science is bound by tradition, rules, peer pressure, complacency, and overconfidence, all of which can lead to mistakes and the creation of myth.

Western science has, unfortunately, a long history of self-aggrandizement that has often failed to acknowledge the reality of its limitations and negative impacts. In 1898 Alfred Wallace boldly trumpeted that:

> A comparative estimate of the number and importance of these [scientific] achievements leads to the conclusion that not only is our century superior to any that have gone before it, but that it may be best compared with the whole preceding historical period. It must therefore be held to constitute the beginning of a new era of human progress.

Wallace's statement can also be read as a cultural statement because of its emphasis on human progress rather than on scientific and technical progress. He is also championing the superiority of Western culture by its lack of due regard for the profound achievements of earlier scientific cultures. Indeed, it is also to be read as an exclusion of

the other kinds of science and culture, the ones that were colonized and repressed by the imperial overlords he was happy to represent. In this respect Western science and its imposition on a global scale is also part of a greater cultural imperialism. Therefore, its global spread is not solely a function of its superior analytical or any other capacity but also because of the growing global hegemony of Western culture.

Important elements of this growing cultural hegemony were the values and practice of Christianity. Although science is often represented as rational, positive, and secular there are, in historical reality, numerous examples of science and scientists situating themselves next to spiritual matters and the Church rather than in opposition. Indeed, by attaching themselves to the Church, scientists have hoped to lend some much needed credibility to their work. The point here is that science is not just a technical artifact. It is an artifact that is used to help us deal with uncertainty and is, therefore, culturally powerful and serves a number of functions similar to those that religion does—but as a secular religion. Thus, it is often said that technology is the world's dominant religion and science its theology. Indeed, in physics, the exemplar of modern rational science, there is a very strong yearning for making the connection between science and the spiritual realm. This yearning is evidenced in physics book-titles such as *The Mind of God*. For that matter, it has been frequently observed that physicists often regard themselves as the high priesthood of science.

In 1928, geneticist J. B. S. Haldane invoked the secular image of the utopian techno-scientific sanctuary.

> Physics and chemistry have made us rich, biology healthy, and the application of scientific thought to ethics by men such as Bentham has done more than a dozen saints to make us good. The process can only continue if science continues.

We can see not only the unrealistic claims about the providence of science in its pastoral role but, importantly, also the benevolent colonization of the social sciences by science. Here, science is portrayed as having usurped the role of mere saints and seems to be returning us to the Garden of Eden.

3. Imperial Science

As already mentioned, in the age of European colonial expansion a great enthusiasm was evident for the conversion to Christianity of the colonized lands. This spiritual colonization was carried out largely in ignorance of the complexity, appropriateness, and success of the preexisting religions and the effects on the sustainability of the local society of the imposition of the foreign religion. More recently, similar missionary zeal and errors of judgment can be read into the drive to Westernize science in countries with emerging economies.

In some countries like Japan, however, the process of Westernizing science and industry was done on its own terms rather than on the terms of an imperial interloper. Japan's Meiji Restoration embraced the science, technology, and industrialization of the West but it was able to be done in a way that was complementary to the culture and social structures that existed in Japan. Indeed, this Japanese techno-economic complex

continues to have a unique character that is quite distinct from the European and American versions, and has been no less successful in economic terms.

India, on the other hand, has not met with the same level of success despite some decades of concerted effort with science and technology development policies. In India (in contrast to Japan) the same level of cultural integration and structural adaptation of the science and technology development process with the cultural and historical conditions has not been evident. Furthermore, the technology they have developed has not been taken up by local industries, which have continued to favor buying imports. This suggests that trying to imitate the West is a dubious strategy because it is, at the very least, difficult to beat them at their own game.

We need, however, to look for a deeper analysis of the issues than beating the West at their own game. If the science and technology nexus is to be successful in a sustainable way across the globe it needs to be culturally and historically connected to each locality it finds itself in. Because science is a cultural and historical artifact, and because knowledge is not just something in people's heads—it is living, it is something that we have a relationship with and that exists in relationships—it is difficult to generalize about its nature. This means that our ability to use knowledge and the ways in which we make sense of it is sensitive to the context of relationships, history and culture that people are in. One artifact of scientific knowledge can have different meanings and, therefore, different uses in different places. For example, knowledge of the links between deforestation and global warming in the West means that the cutting down of rain forests in the developing world is an environmental problem. In the developing world global warming is more likely to be seen as a symptom of excessive consumption of fossil fuels in the West. Scientific knowledge is not objectively true but socially constructed and, therefore, cannot simply be plugged into the society that is in need of help and be expected to be automatically a success.

Finding these cultural and historical linkages is not easy though. Waves of creative destruction can be seen as each successive technological wave passes through an economy. Old organizational structures are swept away because they prove inefficient, inappropriate, or unfashionable and are replaced by new organizational structures that better match or synchronize with the new ideological climate and with the new technological and organizational capacities for production. However, this process takes time and is best seen as a learning process in which the cultural and historical playing field is in large part made up of shifting sands. Much turmoil and poor return on investment can be found as nations struggle from the bottom of the learning curve to the top. There is, in other words, a lag between when a nation makes the initial investment in science and technology and the benefit of commensurate productivity increases. This time lag can only be increased when the knowledge and technology are poorly matched to the cultural structures they find themselves in. In the West, this lag has been around 30 years, which is long enough. However, in non-Western countries it could easily be longer because the new knowledge and technology are culturally more difficult to learn.

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Bibliography

Chamarik S. and Goonatilake S. (1994). *Technological Independence: The Asian Experience*. 372 pp. Tokyo: United Nations University Press. [This book explores the ways in which efforts have been made in Asia to develop science and technology. It focuses on the historical and cultural conditions that have hindered and assisted this development.]

Fuller S. (1997). The secularization of science and a new deal for science policy. *Futures* **29**(6), 483–503. [This article explores the relationship between science, religion, and other institutions, and in particular the way in which science has imposed its own conservatism on the creation of knowledge.]

Polanyi M. (1964). *Science, Faith and Society*. 108 pp. Chicago: Phoenix Books. [This book examines the false belief that Western science is wedded to hard facts (explicit knowledge) and the faithful application of the scientific method rather than tacit knowledge.]

Sardar Z. (1977). *Science, Technology and Development in the Muslim World*. 215 pp. London: Croom Helm. [This book looks at the development of science and technology in Islam, and explores issues related to Islamic ideas of what knowledge is in relation to the science and technology development.]

Sclove R. (1997). Research by the people, for the people. *Futures* **29**(6), 541–549. [This article shows the role that science shops have played in the democratization of scientific research.]

Turnbull D. (1997). Reframing science and other local knowledge traditions. *Futures* **29**(6), 551–562. [This article describes performative and representational knowledge and science while arguing that performative science from the non-Western world is a powerful force in development.]

Wertheim M. (1996). *Pythagoras' Trousers: God, Physics and the Gender Wars*. 297 pp. London: Fourth Estate. [This book takes a feminist view of the history of physics and shows how rather than being in opposition to religion, physicists initially used the credibility of the Church to legitimate much of their knowledge and later posited themselves as the high priests of science.]

Williams F. and Gibson D.V.E. (1990) *Technology Transfer: A Communication Perspective*. 302 pp. Newbury Park: Sage [This book argues that technology transfer is often a communication issue. It examines cases of unsuccessful transfers of technology from West to East from this perspective and shows how they are communication failures.]

Biographical Sketch

David Rooney is a senior lecturer in Communication Management at the School of Management, University of Queensland, Brisbane, Australia. His main research interests are in knowledge studies and technology studies, with a particular interest in knowledge-related public policy.