



**The End of Time.** Enzo Tiezzi. WIT Press, Ashurst Lodge, Southampton, SO40 7AA, UK. 2003. 200 pp. Price: US\$ 75.00.

Few would deny that our world today has been drastically transformed by science and technology. But there is also a growing uneasiness as to whether this transformation is indeed for the better. There is now enough of a challenge posed to the modernist view that saw social development largely as technological development. The environmentalists have been instrumental in leading the charge against this vision of development. While their focus has been on the disastrous impact of science and technology on our environment, they have also succeeded in broadening the terms of the debate to include fundamental questions on the nature of development, limits to growth, ethical responsibility of scientists and so on.

Enzo Tiezzi is one of the early voices against the irresponsible application of technology. The book under review has now been translated from the original Italian version published two decades ago and some of what is said here has become part of mainstream and popular discourse. Since the basic issues that are raised are important, re-emphasis of these issues is always welcome. While the literature on environmental impact, sustainable development, appropriate technology and the like has grown, some fundamental issues such as the conflict between human freedom and responsibility, desire versus restraint still remain on the philosophical margins.

It is precisely these issues that need to be considered, if we hope to have any reasonable solution in the near future. For example, should there be a limit on scientific activity? Will this limit be imposed by scientists or outsiders? Is the activity of science inherently against the idea of limit? Is technology dictated more by commercial interests than by a desire for social development? While this technological society

may have increased material benefits, has it at the same time decreased the 'quality' of living? Do we need another model of science, a model which will give a more humane and responsible face to science? To have this model, what needs to change: the character of science or scientists?

We can respond to this problem of development, as far as the role of science is concerned, in different ways. One is to claim that science and technology are only part of a complex social process and they alone should not be blamed. As a consequence, there is really no change required in science. On the other hand, some have argued that science and technology are inherently violent and anti-human. Tiezzi chooses an intermediate path between the above two alternatives. He believes that what is needed is not radical denial of science and technology, but a different 'kind' of science. He believes that this new science, which will inspire a new model of development, should not only be scientific, but also 'ethical'. And, most intriguingly, he thinks that the tools needed to develop this new science are thermodynamics and biology. Specifically, the concepts of entropy and Darwinian theory of evolution.

This may seem baffling at first sight, but what Tiezzi sees in entropy and evolution are the ideas of limit and renewability. It is reasonable to believe that uncontrolled growth is inimical to a world that has only finite resources. Tiezzi wants the notion of limit to arise 'naturally' – that is, as laws of physics and biology instead of ideology. His solution begins with the biological steady state model: evolution with minimum production of entropy and maximum thermodynamic efficiency. The new model of development necessitates, among other things, decentralized production, slowing of the entropic process, use of appropriate technology and using renewable resources. The supremacy of biology should dictate the new economics.

How tenable are these ideas in formulating a science with a human face, especially one derived from the notions of entropy and evolution? Can science accommodate these changes without losing its essential character as 'science'? Since the problem is in the science–nature interface, it is particularly important to understand the relation between science and nature.

This relation is essentially adversarial. Nature poses the primary challenge to science: the secrets of natural laws, limitations of our senses, disease and mortality,

and so on. The scientific spirit in understanding nature always attempts to go beyond the limitations imposed by nature. Scientific methodologies are sometimes designed on the belief that nature must be conquered before she reveals her secrets. Now, if science has to change to accommodate nature rather than confront it, it will have to challenge its essential character. Is science ready to do this? Unlike what many like to believe, the problem is indeed with the nature of science and not only with the scientists.

In the context of evolutionary paradigms like Tiezzi's, the problem is compounded by the confusion in looking upon humans as being 'outside' nature. The role of the human mind will complicate the issue further. If the human mind (which creates science) is a by-product of nature, then it can be argued that the mind evolved in order to create catastrophic changes in nature, and therefore the problems of development are part of a 'natural' evolutionary process.

What we need for the kind of change that Tiezzi and many others want is to enlighten scientists about the great responsibility that they have – they are humans first and scientists next. It would also help if scientists learnt something about the nature of science. It is indeed surprising that science students are not exposed to even rudimentary ideas of science studies, history and philosophy of science. This ignorance reinforces the image of scientists as blundering bulls in a delicate and complex world. Tiezzi's repeated observations that the negative impact of development is greatest in Third World countries makes it important that scientists in these countries do not merely ape what their counterparts in the rich societies do, but learn to articulate a new vision of science. On the face of it, this seems like a hopeless task because we have well bought into the story that science is universal. Until we learn to reassess this view, it is these societies, including our country, which will pay the maximum price.

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