Chapter 1

Introduction

The past 250 years of human history have been marked by extraordinary achievements in technology and science. By the end of the 19th century there was a mood of great optimism that technology and science would provide solutions to almost all human problems, particularly those associated with poverty.

This mood of optimism possibly reached its zenith in the 1960s, owing partly to the achievements of space travel, and partly to the development of nuclear technology, which seemed to promise a future in which the world’s energy needs would be met by electricity ‘too cheap to meter’.

However, these optimistic expectations had already begun to be undermined in the 1930s. By the 1950s and 1960s two strands of misgiving were apparent. These lead in due course to the emergence of appropriate, intermediate, and alternative technology as concepts to be taken with increasing seriousness.

These concerns evolved out of the awareness of the impact on the natural environment of technological activities—pollution and wastage and the high consumption of natural, in particular, non-renewable resources. These made possible and were themselves driven by the materialistic way of life, based on high consumption and ever-increasing economic growth.

The global attempts to alleviate poverty in the developing world, which houses seventy five percent of the global population also facilitated a shift in the thought
process towards the emergence of appropriate technology. It had been natural to
suppose at the outset that the best way to do this was to facilitate in these countries
the kind of technology that had lead to such prosperity in the richer countries.

1.1 Appropriate Technology

Appropriate Technology can be broadly explained as a technology intended to be
suitable to the needs and resources of a particular locality or a community. An
appropriate technology generally relies on local skills and resources, is intended not
to disturb the local situation economically and culturally, and aims to be benign to
the environment. An adequate explanation of the term and of the associated concepts
of alternative technology and intermediate technology requires a brief survey of the
historical context in which these terms arose.

A classic example is that of tractors provided for agriculture in Africa, where the
necessary infrastructure and specialized skills to keep the tractors maintained were
largely lacking, that after a short period they became heaps of rusting metal. In the
Indian context, Amulya Reddy reflects; ‘In our hierarchical societies it is not only a
question of smaller technology, but also of people’s control of that technology.’ He
offered the following evidence. The development of small water pumps in South
India that are made locally but are inaccessible to small farmers who have neither
cash nor access to the credit needed to buy even the cheapest models. Technological
appropriateness is therefore not only a matter of introducing new gadgets into the
village, but of equity, of introducing new systems of land-tenure, land use, banking,
cooperative ownership, management, maintenance of equipment and, eventually, of
the apportionment of the produce for local use or sale.
Very commonly what appears to be a straight technological problem is to do with other more complex issues, such as the local economic climate, the opinions and agenda of those in power in relation to those without power, and, often, beliefs and attitudes concerning gender roles. Technology is more than a tool: it has become both our environment and our ideology. Technological concepts determine our visions, colour the way we perceive problems and define the way we work out solutions.

The links with technology and industrial development were intensified during the nineteenth century, in new types of scientific universities, industrial research laboratories, and technological colleges, that by the early twentieth century, science had become a legitimate and highly significant part of Western culture. It was this institutionalized science that was transferred to, or imposed upon, the rest of the world in the "age of imperialism," supplanting other, indigenously generated forms of knowledge production and dissemination.

The industrialization of science can be seen as having gone through three main stages since the Industrial Revolution of the late eighteenth and early nineteenth centuries. In the first stage, scientific education came to be oriented toward industrial needs by the creation of new scientific universities and technical "high schools" and the infusion of science and laboratory teaching into university curricula. The new technologies also lead to new scientific discoveries and theories in thermodynamics, electricity, organic chemistry, geology, etc. From the second half of the nineteenth century, industrial research laboratories started to be established, in both Europe and the United States, and, in this second stage, engineering grew closer to science in its organizational and conceptual identity. The
final stage, which is more recent and still developing, involves a more systemic process of integration, connecting science, engineering, marketing, and management into a more all-encompassing techno-structure or techno-science. The industrialization of science is thus a pattern of inter-linkages and mutual influencing, so that science in the late twentieth century is no longer the same thing that it was in the seventeenth century. It is now ever more difficult to separate science from its technical uses, or to extract it, as some kind of pure ideational essence, from the innovation chains and corporate strategies in which it has become enmeshed.

The concept of appropriate technology has two major dimensions, - in one plane it takes the shape of a movement towards a total decentralization, and in another level it assumes the shape of a set of specific technologies to tackle a locally relevant problem without creating much further problems.

**1.2 Appropriate Technology: A Movement**

It is as part of the efforts to achieve independence from foreign domination that non-Western intellectual traditions will be considered. Here it is possible to delineate two main approaches: a traditionalist approach, which has sought to revive the pre-colonial past in a more or less unadulterated form, and an integrative approach, which has sought to combine elements of indigenous traditions in one or another developmental framework. In all of the liberation struggles in the so-called third world, there has been a tension between the two approaches, and in most developing countries there continue to be conflicts over the most appropriate way to develop “non-Western” ways of doing science. A wave of opposition to Western science began to take shape as part of the widespread questioning of Western-style
development that emerged in the anti-imperialist movements of the 1960s. What was at stake was not primarily the Western science and technology that was central to development but the orientation to the imperialist centre, but the dominance that the imperialist countries continued to exercise over the newly independent countries of the third world. In order to continue the struggle beyond independence to a true national liberation, it was necessary among other things to take the pre-colonial past much more seriously and to question some of the positivist assumptions that had hitherto guided the development of science and technology.

In the 1970s, appropriate technology - by which it was usually meant the creative combination in particular contexts of traditional and modern techniques to meet the problems at hand - developed into a multifaceted movement. In other terms, appropriate technology addressed or challenged the technological dimension of Western science and sought to break the link that had been formed already in the early modern period between the development of science and the development of practical techniques. Appropriate technologists argued for a return to an artisanal technology, a technical ideal that focuses on the craftsman rather than the scientist as the main source of innovation. Appropriate technology tended to be seen as a process of development from below, a non-scientific, locally based technical activity that made better use of the available human and natural resources than a technology development from above, directed by scientific experts with little awareness of local conditions and capabilities.

Appropriate technology had difficulty in meeting the challenges of the new advanced technologies of microelectronics and biotechnology that began to appear in the international market place in the late 1970s. These technologies were based on
the latest scientific understanding and thus seemed to imply a re-Westernisation. Appropriate technology, in the course of the 1980s, tended to be marginalized, and now serves not so much as a real alternative to Western science and technology as a nostalgic memory. Particularly important were the efforts made to reinterpret the pre-colonial scientific traditions. In Latin America, as part of the effort to save the tropical rain forests from extinction, the ethno botanists of the Amerindians were rediscovered, and, by now, research institutes have been established to carry out agricultural programmes based on the revitalized traditional knowledge. In China, acupuncture and herbal medicine have not only become fully legitimate parts of medical science and treatment but they have been transferred to the rest of the world as a visibly non-Western way to treat the human animal. In Africa and Central America, the pre-colonial astronomical and cosmological theories have been rediscovered and some of the mysteries of modern astrophysics are beginning to receive different kinds of explanations when they are filtered through the non-Western paradigmatic and cosmological frameworks.

Gandhi, of course, was Western-trained and learned about Western philosophy and Western science while studying law in Britain. Perhaps most important for our purposes here is that Gandhi became acquainted with Western traditions of cultural criticism, associated with such names as Ruskin, Tolstoy and Thoreau. The "experiments with truth" that made up Gandhi’s life were, in large measure, a conscious effort to combine these critical Western ideas with a very personal interpretation of Hindu belief. Gandhi embodied an alternative science and technology in his own person, but he was not particularly successful in writing about it or in institutionalising it. He has served, in post-independent India, as both a
legend and personal model; and, as one shall see, his inspiration can be seen in a number of alternative activities in India today.

Gandhi was not alone in his attempts to develop alternative approaches to science and technology in colonial India although it was his vision that has perhaps been most influential. Ashis Nandy has recently contrasted Gandhi's "critical traditionalism" to the more absolute glorification of tradition represented by the art historian and Buddhist scholar Ananda Coomaraswamy. Where Gandhi made use of Indian traditions in an open-ended, reflective way, Coomaraswamy's "tradition remains homogeneous and undifferentiated from the point of view of man-made suffering.... Today, with the renewed interest in cultural visions, one has to be aware that commitment to traditions, too, can objectify by drawing a line between a culture and those who live by that culture, by setting up some as the true interpreters of a culture and the others as falsifiers, and by trying to defend the core of a culture from its periphery".

However, as time passed, a number of economists, in particular the German-born British economist E. F. Schumacher argued that "minority world" advanced technology was rarely appropriate to the situation of people in the majority world, and that an alternative technology was needed.

Schumacher formulated the concept of intermediate technology, something, as he said, "between the sickle and the combine harvester". He proposed ways "to find out what people are doing, and help them to do it better", rather than disrupting local cultures and communities by the intrusion of technologies that ignore local materials and render local skills obsolete.
Schumacher argued that the model of development that the minority world practises is environmentally unsustainable. He said, ‘The Earth cannot afford the ‘Modern World’. It requires too much and accomplishes too little’. The capital-intensive technology of the minority world was itself inappropriate, not only to the majority world, but to the planet as a whole. Concerning the relation between the economic system and technology, he said ‘the main content of politics is economics, and the main content of economics is technology’.

It is thus impossible to discuss the concept of appropriate technology without consideration of the debate about the environment and the economic system that has emerged in the past two decades. There is now a fierce contest between the proponents of high technology and those who support the appropriate technology approach. The latter believe that this contest is the crucial debate of our time.

A wider approach to appropriate technology takes into account the processes of the development of technologies—the skills and knowledge that go into them. Respecting the local knowledge is a part of this. It is often an alternative to the highly capital-intensive development project.

Certain criteria for the appropriateness of technologies have been confirmed in practice. Technologies are considered appropriate if they (1) contribute to meeting basic needs, (2) use and develop local natural and human resources, including capacities in autonomous technology development, (3) overcome economic dependence and promote self-reliance, (4) are compatible with the culture and knowledge of the users, (5) lead to creative participation and reduce excessive workloads, and (6) avoid pollution and depletion of natural resources. But it has also
been understood that general criteria are never exhaustive. They must be modified, supplemented and weighed according to the specifics of each case.

Charlie Chaplin's famous movie "Modern Times" was post-modern in the most literal sense of the term. It was made at a time when all but a few artists and critics believed in the "modernity" of the early 20th century. Chaplin was among the first to point out the negative impact of large-scale industrialism on the life of those working under the rule of the machines. Since then post-modern has become a slogan with countless different connotations. The essence of the concept, however, is to undermine a simplistic belief in technical progress as the solution for all problems. Post-modern stresses the values of diversity and plurality. While technology continues to be of crucial and still growing importance in the post-modern context, the determination of appropriateness becomes most essential. Appropriate technology in post-modern times implies "mastering the machine" in the interest of many diverse socially and environmentally appropriate solutions.

1.2.1 Appropriate Technology: The Lineage

Appropriate technology has evolved through three successive stages. The vision of appropriate technology can be traced to the philosophy and writings of Mahatma Gandhi. Later Joseph Cornelius Kumarappa, translated his vision into a programme of action. It was E.F Schumacher, who made this vision to a worldwide movement. It was he who coined and popularised the words appropriate technology and intermediate technology.
1.3 Appropriate Technology: A method

As a specific technology practice, appropriate technology attempts to integrate the following four dimensions:

Technical-empirical, i.e. developing and using technological hardware (artefacts) based on empirical knowledge;

Economic-ecological, i.e. relating to various economic systems (subsistence, local and regional markets, national and global macro-economic relations) and the respective ecosystems;

Socio-political, i.e. incorporating the various perceptions, strategies and activities of social groups, institutions and organizations;

Socio-cultural, i.e. considering people’s behaviour, values, customs and cultural identities as the basis of autonomous technology choice and self-reliant action.

1.4 Appropriate Technology: Relevance and Dynamics

Though the concept of appropriate technology evolved and gathered momentum in the context of developing countries, it is becoming all the more relevant in both developing and developed world. The human face of the technology, which was missing in the large scale, high-technology systems of the west, and a plethora of problems due to ‘inadequate’ technology in the developing world necessitate a solution that can tackle the problems at both levels. The problems in the developing world are acute and require solutions at different levels. The changing demographic pattern, consumption patterns and life-styles increase the obsolescence of technology, even that of a technology which was appropriate at an earlier time.
Appropriate technology does not provide solutions that are permanent, but it evolves with the changing environment.

1.5 The research Problem

The present study attempts to find the dynamics and relevance of appropriate technology in the local context. The society-resource interface is very complex and requires a variety of technologies for this interface. Deutsches Zentrum für Entwicklungstechnologien (GATE - German Appropriate Technology Exchange) defines “Appropriate technologies” as those that are suitable and acceptable in the light of economic, social and cultural criteria. They should contribute to socio-economic development whilst ensuring optimal utilization of resources and minimal detriment to the environment. Culture embraces all aspects of life: know-how, technical knowledge, clothing and eating habits, religion, mentalities, values, language, symbols, socio-political and economic behaviour, ways of reaching decisions and yielding power, modes of production, and more. Every society has a large body of technical knowledge based on careful observation and use of its natural resources. The present study is an attempt to look into the appropriate technology solutions relevant in the context of Kerala, the geographical region selected for the study. Since the areas of life, where technology has a definite say is very large, it would be practically impossible to look into all the existing technologies, including appropriate technologies, within the frame work of a academic research constrained within a definite time frame. Hence for the purpose of the detailed case study the relevance of appropriate technology in water resource management is investigated in detail. The issue of water resource management is
taken as the focus of the research owing to the central importance of water in the maintenance of life support systems. The state with a humid to per humid climatic conditions and with a reasonably high rainfall gets into severe water shortages in the summer. The mid lands and high lands get into water shortage during the summer and the coastal Kerala is plagued with floods and associated problems throughout the monsoon. The issue of water management assumes paramount importance in this situation. The mainstream capital and technology intensive solutions, which are mostly huge in scale, are compared with the solutions offered by appropriate technology.

1.6 Objectives of the study

The present study is an attempt to look into the relevance and dynamics of appropriate technology, from the perspective of sustainable development. Apart from looking into the theoretical issues in appropriate technology, the study also tries to look into some practical examples of application of appropriate technology. The issue of water resource management in Kerala is taken for a detailed study, and it is analysed at two levels, both macro and micro. The specific objectives of the study are as follows.

1. To study, the concept of appropriate technology in detail, particularly in the context of developing nations.

2. To study the relevance of appropriate technology in the context of current problems, related to technology, society and ecology.
3. To study the dynamics of appropriate technology, and people’s role in evolving a technology to solve local problems.

4. To critically examine those technologies which are generally projected as appropriate, from the perspective of sustainable development.

5. To study, the relevance of appropriate technology in water resource management in Kerala.

6. To critically analyse, the problems of water resource management in Kerala.

7. To make a detailed case study of some of the appropriate technologies used in water resource management.

8. To recommend policy suggestions based on the present study

1.7 Limitations of the study

Restricted within the framework of a Ph.D. program, collecting data from more a couple of panchayats was not possible. Hence the micro-level study had to be restricted to two panchayats. There are no reliable data regarding irrigation potential, water availability etc., available at the micro level. Wherever the data are available, the authenticity is questionable. So most of such information had to be collected personally, which involved more time and money. Participatory research requires longer time periods of stay in the field, which was not possible within the constraints of a formal research program. A holistic study of water resource management requires an interdisciplinary teamwork, and is beyond the scope of a doctoral research. Hence a deeper investigation into the socio-cultural practices underlying the water resource management traditions could not be done.
1.8 Chapter Scheme

The rest of the study is organized as follows:

The second chapter titled ‘Methodology and Review of Literature’ describes the methodology adopted for carrying out the present research as well as gives a detailed background and review of research done in appropriate technology and water resource management.

Chapter three ‘Appropriate Technology – History, Concept And Evolution’ provides a background for the research. The evolution of the concept of appropriate technology is traced; the problems of technological development are dealt with in detail in this chapter.

Chapter four, ‘Appropriate Technology—Theory And Practice’ describes the global experiments in appropriate technology. The concept, meaning and characteristic features of appropriate technology are explained in this chapter. The relevance of the appropriate technology, particularly in the context of developing countries is also discussed.

Chapter five ‘Dynamics and Relevance of Appropriate Technology: A Macro-Level Analysis of Water Management Systems in Kerala’ brings out the macro level issues in water resource management. The chapter is divided into three parts. Part I describes the water resources of the state, Part II is a critical qualitative analysis of the problems of water scarcity and Part III describes different approaches in management of water resources.

Chapter six, ‘A Micro-level Analysis of Water Resource Management in Kerala: A Case Study of Relevance and Dynamics of Appropriate Technology’ provides the
details of the case study conducted in Mulakkulam and Karukutti Panchayats in the midlands of Kerala.

Chapter seven concludes the study enumerating the main findings and suggesting policy recommendations.
Notes and References


