Appropriate Technology

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The appropriate technology movement emerged in the early 1970s from two related critiques of the large-scale industrial technology used in both the capitalist West and the communist East, one focused on conditions in the industrial states and the other focused on the impact of exporting technologies used in industrial countries to the developing countries of Africa, Asia, the Middle East, and Latin America. The bases of critique applied to industrial countries were that large-scale technologies promoted over-exploitation of natural resources, over-centralization, concentration of political and economic power, less employment because high technology substitute machines for workers, and deskilling of workers because more of the work process is embodied in the movements of the machine rather than in the actions of the operator. The bases of critique applied in developing countries were that industrial state technologies, developed as they were in capital-rich and relatively labor-short economies, failed to fit the capital-poor and labor-abundant factor endowments of developing country economies, that they were too expensive for the country in general and especially for the poor, that they were seldom culturally appropriate, and that their operation assumed availability of infrastructure and levels of general understanding about how technologies work that were absent locally. In sum, the argument is that technology has been developed too far and now dominates humanity rather than serving humanity.

The founder of the appropriate technology movement, E. F. Schumacher, argued that technology should be designed in ways that would promote health, beauty, and permanence. Technology should not be regarded only as a means to an immediate end, it must be evaluated in terms of its contribution to a process of production or activity beneficial not only to its immediate users, but also to the society at large.[1] He faulted out conventional economic thinking in both West and East for failing to consider the most appropriate scale for an activity and condemned notions that "growth is good", and that "bigger is better." He questioned the appropriateness of using the typically capital-intensive methods of mass production in developing countries; he argued instead for what he called "production by the masses," that is, use of or labor-intensive methods. Schumacher was one of the first economists to question the appropriateness of using GNP to measure human wellbeing, emphasizing that "the aim ought to be to obtain the maximum amount of well being with the minimum amount of consumption." Thus he regarded a single-minded concentration on output and technology as dehumanizing. In his view work places should first be dignified

[1] E. F. Schumacher, when *Small is Beautiful: Economics as if People Mattered* (New York: Harper and Row, 1973).

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and meaningful. Efficiency is still important but must be defined by the propositions that nature is priceless, and that depletable resources should be treated as capital assets to be carefully husbanded over time rather than as income accruing anew every year.
It is not surprising that the appropriate technology movement took off in the wake of the 1973 oil crisis, which highlighted the centrality of inexpensive fuel to the development and maintenance of post-World War II prosperity, and cast doubt on the likely success of continuing along the paths of economic development followed since the start of the industrial revolution. The appropriate technology critique also fit well with the broader "counterculture" discontent with modernity that had been spreading since the late 1960s. The phrase "high technology" began to lose its luster, becoming identified in many minds with excessive mechanization, displacement of human labor by machines, wasteful depletion of resources, and increased pollution. While the later computer revolution restored luster to the phrase "high technology" (especially in its shorter "hi-tech" form), resistance to capital-intensive and centralizing technologies persisted.

Though Schumacher insisted on the importance of ecological sustainability, most advocates of appropriate technology focused primarily on the needs of developing countries in the 1970s and early 1980s. As the environmental movement gained strength later in the decade, however, the concern about the environmental implications of technology increased. That element was incorporated into both the industrial and developing country visions of the appropriate technology movement.

In the words of some current advocates:

> "[Appropriate technology] is suitable for the circumstances or purposes for which it is designed, and it is sustainable - meaning it is capable of being maintained at a steady level without exhausting natural resources or causing severe ecological damage, forever.
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> It is the sort of technology that is right for small-scale, grassroots, people-centered economics. Appropriate technology is about being mindful of our actions and the consequences of those actions. It is the foundation of sustainable living and therefore works from the bottom up to meet grassroots economic needs, not from the top down. Fundamentally, appropriate technology is about caring, helping and appreciating and forward-thinking. It is as much a philosophy, a way of seeing things, as it is a technology.
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> Because appropriate technology is firstly a grassroots technology it is expressed in an extensive array of inventive, creative solutions to problems, that 'outsiders' would be unlikely to consider. The very diversity of appropriate technology means that it changes with each situation - there is infinite variety in real life situations where appropriate technology is used and it must fit each of these situations. Whereas non-appropriate technology often forces life to fit the technology."[2]

Advocates of appropriate technology have been very enthusiastic about renewable energy not only for its environmental benefits but also because it will allow households, firms, and communities to disconnect from the massive power grids that now crisscross the industrial world and make people dependent on capital-intensive infrastructure operated by governments or by large monopoly firms. They have also been enthusiastic about compressed earth block (CEB), a building material made by mixing the right proportions

[2] www.ustechnologysolutions.com

of dirt, clay, small stones, and a small amount of water, putting the mix into a mechanical press, and forming it into a block. CEB blocks have a number of advantages over other building materials: in humid areas they can be formed without adding water, and the small amount used in dry areas also means drying time is less than needed for other forms of block or brick, suitable soil is often very close to the building site so saves on shipping costs, a single mechanical press can produce anywhere from 800 to 5000 blocks of the day (5000 being enough to build a 1200-square foot house), the press gives the blocks a uniform size, truly flat sides, and 90° angle edges allowing easier building, and the external appearance is similar to that of stucco houses, the "mortar" used to connect the bricks is simply the same dirt-clay-water mix used to make them. Construction with CEB is simple enough that unskilled labor can perform most of the work. They are made from natural materials that do not include any toxic chemicals and therefore produce no out-gassing. The resulting walls are fire resistant, sound resistant, insect resistant, and mold resistant because they are dense and do not include any paper materials.[3]

Appropriate technology is often described as “simple,” but it is a mistake to assume that the most appropriate technology is the simplest tools or machines capable of doing a particular job. They may not actually meet the criteria qualifying a technology as “appropriate” in a particular situation. Two sets of criteria guide selection: ecological sustainability, and social equity. Ecological sustainability means selecting those technologies that will do a particular job or permit a particular activity with the least amount of pollution, waste, or harm to the surrounding environment. Social equity means selecting technologies that can be acquired, operated, and maintained locally at levels of cost affordable to local users, whether those users are rural and small-town dwellers in industrial countries or the poorest members of the rural and urban populations in developing countries. In most situations, several technologies or devices meet the criteria. Thus, a concern with appropriate technology does not by itself determine the selection of the tool for a particular job. Rather, it provides a set of guidelines for choice that identify some possible choices as undesirable and others as desirable, and encourages selection among those identified as desirable.

Advocates of appropriate technology have sometimes caused confusion, even for themselves, by using several overlapping terms to describe the desirable sorts of technology. The process began with Schumacher himself, who introduced the term "intermediate technology" to describe technology that is more effective though more expensive than the technologies prevailing earlier in developing countries, but at least an order of magnitude (10x) less costly than the technologies used in industrial countries. Though more expensive than the less effective traditional technologies, with a lower cost, does make intermediate technologies available to small businesses and village groups. The term "blended technology" has been used to describe an appropriate technology that has been modified in some ways to accommodate cultural differences among users. The term "soft technology," also first used in the 1970s, acquired two meanings. The first was developed by Amory Lovins[4] in his phrase "soft energy paths," with which he contrasted renewable energy sources, such as windmills or solar cells, to the "hard paths” of fossil fuels or nuclear reactors commonly used in the industrial economies. The second usage or a first two sets of rules, guidelines, or outlines of the steps involved in some activity that exist inside human brains rather than being embodied in a physical device or even a computer software program. These are also technologies in the sense that they permit accomplishing some activity, but they are very different than the fabricated devices we usually associate with the word "technology".

[3] See producer websites at www.beyondadobe.com or www.earthblockinc.com

[4] Amory B. Lovins, Energy Paths: Toward a Durable Piece (San Francisco: Friends of the Earth International, 1977).

"Appropriate technology" can be described as "low impact technology," but its development often rests on highly advanced scientific and engineering research. The windmills distributed by appropriate technology providers today are much more efficient than the windmills distributed in the 1980s because they incorporate the considerable learning about turbine design, mechanisms for steering the blades to catch wind most effectively, materials, and windmill placement that has occurred over subsequent years. New research findings about the way water carries cholera germs inspired development of a new type of cloth filter that villagers in cholera infested areas can use to purify their water supply.

The promises of low cost, easy maintenance, small scale, and low environmental impact make appropriate technologies highly attractive to many users in both industrial and developing countries. A large number of nongovernmental organizations, foundations, government agencies, and intergovernmental organizations have supported the diffusion of particularly simple or intermediate technologies around the world.

With any technology, attention must be given to the physical and social conditions under which the technology will be used. Suppose the problem at hand is improving the water supply for a remote village. Technology choosers must first consider the character of the available sources of water. If groundwater is located only at a large depth say 50m below the surface, the village will need a mechanically drilled well and a submersible electric pump. If groundwater is located between 10 and 50m below the surface it will be possible to dig the well manually, but an electric pump will still be needed to bring the water to the surface. If groundwater is within 10m of the surface, then it is possible to use hand pumps or foot treadle pumps because they can operate without electricity and are mechanically simpler. Some models of hand pumps have to be used regularly and maintained carefully or they will fail. However, their mechanical simplicity means they can be repaired locally. Surface water is available in some areas, but may need treatment before it is safe to drink or be used for irrigation. Engineers have developed a number of relatively small-scale water treatment systems being used extensively in South and Southeast Asia. Locally-operated “water refill stations,” sometimes known as “water treatment kiosks,” employ sophisticated methods such as multistage particle filtration, UV irradiation, ozonation, or membrane filtration to purify water, bottle it (or refill customers’ bottles), and sell it to the local population. Water quality can vary and government authorities often need to keep an eye on the entrepreneurs to make sure they do not engage in price gouging. Properly regulated, these small enterprises deliver safe water at affordable prices. In areas that experience considerable fog, it is possible to harvest water by capturing the fog and channeling the resulting moisture into barrels or older storage facilities. Areas that experience plentiful and regular rain can rely on rainwater harvesting systems. In some areas the collected rainwater can be used as it is but in others it requires some purification before being used for drinking. Rainwater harvesting obviously does not work very well in areas where there are lengthy dry seasons; people living in such areas will have to rely on other technologies.

The complexities that can arise in assessing what technologies are “appropriate” can be seen in reactions to one type of rural water collection technology. More than a thousand "roundabout play pumps" developed by a South African company are used by villages in five countries of southern Africa. The system attaches a playground merry-go-round to a water pump. Children playing on the merry-go-round by running with it to start it moving and then hopping on to ride provide power for the pump which delivers water into a 2500-liter tank standing about 7 meters (21 feet) above ground. Users access the water in the tank through a tap valve. Any excess water raised by the pump is diverted back into the ground. The storage tank also has panels on its four sides available for posting signs. Two carry advertisements yielding revenue that helps

pay for maintenance of the pump. The other two carry public health messages, often focused on HIV/AIDS prevention. The pumps free women and children from the task of going to a more distant stream or other water source for drawing water and bringing it back home. This permits the children to spend more time in school and the women to devote more time to agriculture or other income producing activity. While the technology itself certainly qualifies as intermediate, some people question its appropriateness on two grounds. First, each pump costs several thousand dollars, a high price for a village. However, that problem is often solved by PlayPumps International, a transnational nonprofit foundation that raises money to pay for the systems. Second, there is some concern about the possible social consequences of using a system that encourages children to associate pumping water with "play". They fear this association will undermine efforts to encourage water conservation or teach children to be mindful of the environment.

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