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TECHNOSCIENTIFIC CONTROL AND ENVIRONMENT*

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In an attempt to review the technological and environmental processes in a holistic framework, the first and somewhat unexpected difficulty appears as a lack of consensus on the meanings of the terms involved.

A survey of the philosophical approaches to the term "technology" reveals a wide range of meanings, descriptions and evaluations. These approaches may broadly be classified as the relativistic, and the ontological.

The relativistic descriptions accept as a premise that technology can only be understood in relation to some other social or cultural aspect of human existence. However, there is little agreement on what this aspect should be. A major group of scholars say that technology is best understood in relationship to production processes. Another group that we may call as the epistemologists, maintain that technology should be studied in relationship to knowledge, science and the scientific method. Another scholar of importance argues that its true meaning can only be understood in relation to human nature. Another's argument is that it should be studied as the central social institution in an overall social context. Still others say that the similarity between technology and the political systems should be analysed and last but not least some say that it can only be best understood by its impacts on our value systems. [1]

The ontological approach on the other hand, maintains that the concept of technology can only be understood as a self centred, holistic and monistic process, which by its very existence determines the nature of the human phenomenon. The real meaning of technology will emerge if it is studied with reference to itself.

In all these various approaches, attitudes and differing opinions, there are however certain common points; and these we shall try to identify in the following two examples.

A prime example of the ontological approach is that of Heidegger's [2], where he attempts to combine various levels of human existence with the real world as it is shaped by technology. In a manner not too easy to grasp, Heidegger identifies two levels of being: that of the "ontic" and the "ontological". In other words, for anything to manifest itself, it must first exist; the level of this required basic level of existence is called the ontological, and has deep meanings for human as well as other beings. The ontic level of existence on the other hand, is made up of manifestations such as shape, colour, density etc. These two levels of being are inseparably linked together, for without existence it is not possible to have manifestations. [3]

The basic question for Heidegger is a meaningful explanation of the ontic structure of technology in relation to the ontological level of human existence.

* A. EVYAPAN, Tekno Bilimsel Denetim ve Yöneldiği Çevreler, ODTÜ Mimarlık Fakültesi Basım İşliği, Ankara, 1981

1 C. MITCHAM and R. MACKEY (ed), Philosophy and Technology, The Free Press, New York, 1972

2 M. HEIDEGGER, Die Frage Nach der Technik, Neske, Vortrage und Aufsatse, Pfullingen, 1954

W. HOOD, 'The Aristotelian vs the Heideggerian Approach To Technology', MITCHAM and MACKEY, OpCit, p. 354

3 Perhaps the interesting question for the existentialists would be the reverse, i.e., 'Is existence without manifestations possible'?

Technology is not a matter of tools and machines, but is a result of a particular frame of man's mind ; the ge—stell. This, based on "concern", directs a challenge and a demand toward nature for her energy. During this challenge, technology discovers the inevitable reality that lies hidden within nature, and sets it free. The results are products which then take their place in the technological horizon, many of which are then employable again as tools.

Tools, an element of Heidegger's structure of technology on the ontic level, are never used singly and in isolation but require the use of other tools; one tool creating a reference matrix for others. Very soon, an integrated tool system made up of many quite different parts emerges. Heidegger calls this system a "structural whole".

Structural wholes perform three important functions; they produce artifacts most of which are further used as tools; they spatialize the environment i.e. open up raw nature and make it habitable; and lastly, they provide the hardware skeleton which brings the five ontic elements of technology, i.e. tools, products/artifacts, nature, theory and organisation, together.

It is relatively easy to define the product of a single simple structural whole. However, structural wholes are expanding all the time, forming progressively more complex hierarchies which complicate definition. Most of the time, the product of one sub—system becomes the tool of the other; at other times, the products themselves constitute complex systems.

Difficulty of definition also applies to nature, as another ontic element in the structural whole. It is not the simple Aristotelian concept anymore, where understanding and defining was once possible with careful observation and meditation. Now it is a highly abstract concept, subject to symbolic and numeric manipulations, making it difficult to determine just where its boundaries are.

This makes the distinction between "natural" and "man—made" quite difficult, leading to unclear definitions of technology. In one respect nature is every where; it is around man in the form of materials, and beyond as energy.

Through theory, another ontic element, our universe of everyday experiences is transformed into a higher level perception of material objects. Theory is perhaps the most uniquely human element in the structural whole and sets human beings apart from all other natural formations along the technological horizon. Although theory is connected with the use of tools, it is misleading to think that modern technology is a product of modern science. The real cause behind the emergence of modern technology as well as modern theory is man's special frame of mind, based on concern. 19th century witnesses a basic transformation in this frame of mind, where it is realised that scientific study of nature helps man greatly in his transactions with environment. This recent realisation has resulted in the combination of science with technology.

Unification of theory and practice had a tremendous impact on the modes of organisation. In a static analysis, two major forces create and determine human organisations, namely the production — consumption dichotomy; and division of labour. When we take one simple structural whole at a given slice of time, it may perhaps be possible to identify an "in" group which carries out production, and the "outsiders" who consume the end product. Furthermore, in such a static framework, a division of labour may be identified in terms of "brains" and "brawns"; along with sources, paths and channels of outside information flow into the "whole". In short, in static analyses of simple structural wholes, it is possible to identify separately "theory" and "practice" both within and outside the system.

However, when viewed along a time axis, no simple structural wholes exist in the contemporary scene. In a very short time, structural wholes combine with others, creating much more complex hierarchies where consumers become producers; outside theory becomes integrated with production; products become more difficult to define; and aims become means — if not vice versa. Thus as organisations grow and change, theory and practice merge, leading to further change in organisations — both in concept and realisation.

In short, like many others, Heidegger searches for "meaning"— and of existence at that. It is only natural that such a quest should leave the ordinary mind out of breath. What is important for us here is that he has identified technology as the basic determinant of the contemporary scene. And, although he studies it on the ontological level, nevertheless certain more elementary terms of reference, or in his terminology, ontic elements of technology are inevitably employed. Thus we have theory or science, products or artifacts, tools, organisations, means and aims, nature and environment, and most interestingly "structural wholes" as autonomous and dynamic systems through which a portrait of technology is drawn.

C. MITCHAM and R. MACKEY (ed), Philosophy and Technology, The Free Press, New York, 1972

A limited survey [4] indicates that for a majority of writers who discuss technology in one form or another, these terms of reference constitute a basic set of recurring themes by which different compositions are constructed, depending on the differing premises, outlooks and philosophies. But on the whole, the recurring themes remain more or less constant.

To illustrate, let us take as a further example, political economists who maintain that technology can best be studied as it relates to the production and partially to the distribution process. Production, along with distribution and consumption, is a process structurally linked with the rest of the socio—cultural system, i.e., both the internal structure of these processes and the structure of the socio—cultural system affect and change each other along a time axis. The social aspects of these myriads of dynamic interrelationships are the study area of Political Economy.

There is however a material aspect of production and distribution, and there we come across terms like: method, technique, science, research, and technology. What is important is that these terms have their appropriate meanings only when taken with the mode or the historical stage of development of different production processes.

For instance, in pre—industrial production systems, the craftsman and the tool constitute a unity so that tools change according to the physical demands of the craftsman as he changes and improves his skills according to the limitations and the possibilities of the tool. In such a background, the meaning of "technique" is imbedded in this craftsman—tool dialectic, and transmission of knowledge requires apprenticeship.

With the coming of fully developed industrial production system, the craftsman—tool dialectic is disrupted. Highly developed and interrelatedly complex machine systems are formed which are oriented towards raw materials.

Thus a dialectic between a component of the environment and the machine systems emerges. The machine system accepts and uses unskilled labour, adjusting it to its own requirements and will. Only when the machine systems are formed, scientific knowledge becomes an integral factor of the production process, and only at this stage of development can the term "technology" assume any relevance.

Thus in a way similar to Heidegger, and of course much earlier we find that classical literature has identified an autonomous structural whole—a steel skeleton of machinery neutral towards and uninterested in human concerns, employing labour, as it were, to its own ends.

Can something be said about the aim, or the purpose, or the meaning of this material skeleton of production? Once the relevance of such an investigation is accepted, it is possible to extend it along two major avenues.

One line of this investigation leads back to the domain of Political Economy. Here it is possible to find many of the causal forces that would both result in, and in turn be further strengthened by such a production framework, eventually ending up in ownership distribution of means of production and political power.

The other line leads to a much deeper human trait which is common to all different production modes, development stages and/or socio—cultural geometry; common in fact to all other living systems in many respects; i.e. the Process of Work. Here we find the elementary motives, the fundamental causes or forces or aims of the man—environment dialectic.

There is a rather dramatic description of the work process in classical literature where man is portrayed as one force of nature starting, standing against, modifying and regulating other natural forces for his own purpose. To this end he uses his body and mind, employing practice and theory; skill and knowledge; himself changing and improving during the process. He has a specific aim, and this constitutes the basic difference between "a bee and an architect". Before producing a tool or constructing his environment in reality, man produces or constructs in his mind.
Again, what interests us here are the terms of reference or common themes usable towards a meaningful description of technology. These terms are: tools, organisations, techniques, theory, science, raw materials as a component of the environment, end—products, and the concept of autonomous machine systems.

At the risk of an oversimplification, these ever recurring themes may broadly be categorised under three study areas:

1 Those studying the relationship between technology and knowledge of all kinds, particularly science;
2 Those studying problems related to aims and means;
3 Those studying technology—environment relationships, including social—cultural—economic—natural environments. In this last area, directly or indirectly, the concept of control is given an important place in a majority of discussions. The underlying leitmotive in the first study area is the theory — practice dichotomy. This has both philosophical and doctrinary implications. Formulated this way, and with some imagination seen as "thought" versus "application" or, "idea" versus "material", it becomes the battleground of controversial views. A common set of questions that are relentlessly pursued in this battle field are, whether for example 'Technology is a form of knowledge'.

If so, 'What kind ?. If not, 'How to explain method and technique'; 'What are the impacts of normative and ontological forms of knowledge and value systems on technology and vice versa'? etc.

One camp at least is adamant in the view that theory and all that stands for, is the prime initatior, and that thought breeds material reality. In a devious way and allegorically speaking, this of course is true; but one could easily advocate the same in reverse. If any conclusion is required, then a brief historical survey is necessary.

There is common agreement in that, starting with the mid–18th century, the three main branches of what then constituted technology i.e. agriculture, medicine, and mechanical arts, underwent an explosive transformation in the western world. This explosion continues to this day, and since then nothing has remained the same. The most striking feature of this explosion, at least in its initial phase, was that science, as was known at that time, had very little to do with it. It took 75 years after its invention, to formulate the theory of the steam engine.

Science was taken as a tool towards "understanding"; a branch of philosophy bringing observational and contemplative faculties into play, improving (along the way) man's rational awareness. Also, based on a Platonic heritage, the scientific circle regarded any form of worldly interference degrading. Involvement in implementation and control was not compatiable with scientific discipline. The aim of science was to re–express nature intelligibly; to breed understanding and then systematically investigate this knowledge.

As the metamorphosis in the technical arts progressed rapidly, first a new kind of knowledge appeared. This was in the form of a very effective dissemination of written material on the emerging technical innovations. Soon, the Universities started adjusting. Curricula changed. Both technology and science started developing common faces of interaction. Universities became practice oriented while branches of technology started developing into disciplines. The meaning of science retained its original formulation as " a systematic investigation of rational knowledge", but the meaning of the term "knowledge" was undergoing fundamental changes. Science was on its way to become a social institution rather than an exercise in contemplation ; "understanding" was leaving its place to " control".

Perhaps an early epitomy of this union was the emergence of the Technical University. It was first founded in Saxony as an Academy of Mining in 1776, and apart from graduating mining engineers, it also became the source of the first and perhaps the only art movement of the industrial revolution. This was Natural Romanticism, a direct outcome of Schelling's Objective Idealism, which maintained the fundamental unity of the "objective" and the "subjective". It was no coincidence that the main body of this movement, i.e., its poets, artists, statesmen, and philosophers were mostly graduates of the Academy.

Again, perhaps a late epitomy of the science–technology union is the emergence of technologies based on scientific research. After a systematic observation of developments in the British agriculture around 1870's, Thaer established the first College of Agriculture, which gave its fruits even when he was alive. Liebig's research on nutrition mechanisms of plants led later on to the establishment of the artificial fertiliser industry, as the first of its kind with its foundations on scientific research [5] .

5 P. DRUCKER, Technology, Management And Society, Harper and Row, New York, 1970, p. 87

From then on, it is the story of the contemporary world. The union of science and technology has created a context of a higher order not explicable and comprehensible either by the concept of science, or by the concept of technology taken separately. In this new context, the classical dichotomies like aims and means; theory and practice; implementation and environment have lost their meaning, mainly because they have merged into complex unions themselves. For instance, theory and practice have resulted in strong syntheses; others are as yet in the form of amalgams. The only certainty in this still very formative and active scene is the inadequacy of classical terminology. Still perhaps, an attempt may be made to locate the relative position of this scientific technology within a simplified but contemporary scenario.

It would not be farfetched to assume that any techno—scientific system can only take place in a greater socio—cultural context; and that in turn can only survive in an ecological framework. These constitute the two categories of environments which are the absolute musts for human survival.

If what the System Theory tells us is valid, then all systems compete for energy. Further, the techno—scientific system is the means by which the socio—cultural system obtains its energy from the ecological system. There is a correlation between the level of technology and accessibility to energy resources. This correlation creates a double and mutual feedback between technological growth, increased energy consumption, greater accessibility to resources, and still more growth. This may very well be the basic dynamic behind the contemporary autonomy of the technoscientific system.

Looking at the contemporary scene, we can confidently say that this autonomy has crucial impacts on and implications for both the socio—cultural and ecological environments, which make the survival of the human species possible.

ÖZET

TEKNO BİLİMSEL DENETİM VE ÇEVRE

"Teknoloji" terimiyle anlatım bulan olgunun, genel bir çerçeve içinde ne anlamlar taşıdığı konusunda bir fikir birliği yoktur. Bu olguyu açıklamaya çalışan yaklaşımları kabaca "göreli" ve "ontolojik" tanımlar olarak iki gurupta toplamak olasıdır.

Çok değişik düşünce, yaklaşım ve tanımların çoğunluğunda gene de, ortak bazı genel temalar izlenebilmektedir. Bu temalar üç gurupta incelenebilir:

— Teknoloji—bilim arası ilişkileri ele alanlar,
— Amaç—araç ikilemi yönünden teknolojinin özellikleri,
— Teknoloji ile çeşitli çevreler arası ilişkileri irdeleyen yaklaşımlar.

"Çevre" kavramı konusunda da değişik tanımlar vardır. Ancak teknolojinin ilişki kurduğu çevreler açısından bakıldığında, bunları "sistem içi" ve "sistem dışı" olarak ele almak olasıdır.

Sistem dışı ilişkilerde temel hedef enerji dönüşümleriyken, sistem içindekilerde hedef bilgi dönüşümleri olarak görülebilir.

Her iki çevrede de, dar ve sektörel bir bakış sonucu, teknolojinin temel işlevini "verimliliği artırmak" olarak tanımlamak olasıdır. Ancak daha genel kapsamlı bir değerlendirme, bu işlevin "denetim" olduğunu ortaya koyacaktır.

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