

## Technology: A Paradigmatic Look

Kavous Ardalan

Marist College

### ABSTRACT:

*Any adequate analysis of technology necessarily requires fundamental understanding of the worldviews underlying the views expressed with respect to the nature and role of technology. This paper starts with the premise that any worldview can be associated with one of the four basic paradigms: functionalist, interpretive, radical humanist, and radical structuralist. The paper looks at the current state of mainstream academic finance and notes that it is founded only on the functionalist paradigm. It argues that any view expressed with respect to technology is based on one of the four paradigms or worldviews. It, therefore, discusses four views expressed with respect to the nature and role of technology. The paper emphasizes that the four views expressed are equally scientific and informative; they look at the nature and role of technology from a certain paradigmatic viewpoint. Emphasizing this example in the area of technology, the paper concludes that there are opportunities for mainstream academic finance, in general, and technology, in particular, to benefit from contributions coming from the other three paradigms if they respect paradigm diversity.*

**JEL CLASSIFICATION CODES: B50, B51, B52, B53**

**KEY WORDS: Philosophy; Worldviews; Paradigms; Perspectives; Diversity**

---

## I. INTRODUCTION

An analysis of technology necessarily requires a fundamental understanding of the worldviews underlying the views expressed with respect to the nature and role of technology. Four general views with respect to technology, corresponding to four broad worldviews, are discussed. These four views with respect to the nature and role of technology are equally scientific and informative; each looks at the nature of technology and their role from a certain paradigmatic viewpoint.

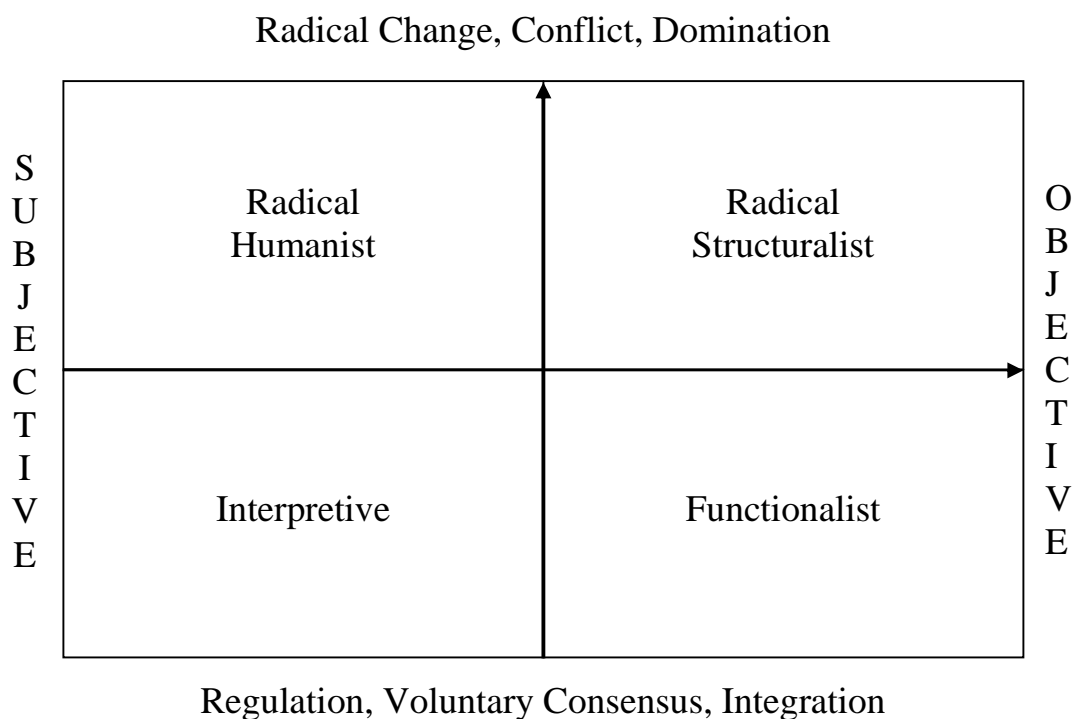
The paper takes the case of technology as an example and emphasizes that, in general, any phenomenon may be seen and analyzed from different viewpoints and that each viewpoint exposes a certain aspect of the phenomenon under consideration. Collectively, they provide a much broader and deeper understanding of the phenomenon. Therefore, academic finance can benefit much from contributions coming from other paradigms if it respects paradigm diversity.

Ardalan (2007a) and Ardalan (2007b) respectively show how each of the four paradigms views and analyzes corporate governance and markets differently and therefore how each one of them can benefit from the insights of the other three paradigms. For instance, as a sub-discipline of economics, mainstream finance does not concern itself with social structure. This paper proposes that the consideration of social structure is one way to improve the insight into the multi-faceted issues in finance.

This paper claims that there is no independent definition of technology because such a definition is dependent on the paradigm or worldview from whose vantage point the technology is viewed. In other words, the definition and treatment of technology depend on the paradigm or worldview from which these subjects are approached. As a sub-field of economics, mainstream finance treats technology as a factor of production and considers its effect on the efficiency with which financial operations are performed. The paper claims that there are other aspects to technology and therefore for a fuller understanding of technology it is useful to also look at the other dimensions of technology, i.e., it is useful to look at technology from other paradigms or worldviews.

Any adequate analysis of the role of paradigms in social theory must recognize the assumptions that underwrite that paradigm or worldview. Social theory can usefully be conceived in terms of four key paradigms: functionalist, interpretive, radical humanist, and radical structuralist. The four paradigms are founded upon different views of the social world. Each generates theories, concepts, and analytical tools which are different from those of other paradigms.

### **Exhibit 1: The Four Paradigms**



The four paradigms are based on different assumptions about; the nature of social science (i.e., the subjective-objective dimension), and the nature of society (i.e., the dimension of

regulation-radical change), as in Exhibit 1.<sup>1</sup> This can be used as both a classificatory device, or more importantly, as an analytical tool.

The paper is organized as follows. Sections II to V, first, each lays down the foundation by discussing one of the four paradigms. Then, each presents the nature and role of technology from the point of view of the respective paradigm. Section VI concludes the paper.

## II. THE FUNCTIONALIST PARADIGM

In Exhibit 1, the functionalist paradigm occupies the southeast quadrant. Schools of thought within this paradigm can be located on the objective-subjective continuum. From right to left they are: Objectivism, Social System Theory, Integrative Theory, Interactionism, and Social Action Theory.

The functionalist paradigm assumes that society has a concrete existence and follows certain order. These assumptions lead to the existence of an objective and value-free social science which can produce true explanatory and predictive knowledge of the reality out there. It assumes that scientific theories can be assessed objectively by reference to empirical evidence. Scientists do not see any roles for themselves within the phenomenon which they analyze through the rigor and technique of the scientific method. It attributes independence to the observer from the observed. That is, an ability to observe “what is” without affecting it. It assumes there are universal standards of science, which determine what constitutes an adequate explanation of what is observed. It assumes there are external rules and regulations governing the external world. The goal of scientists is to find the orders that prevail within that phenomenon.

The functionalist paradigm seeks to provide rational explanations of social affairs and generates regulative sociology. It emphasizes the importance of understanding order, equilibrium and stability in society and the way in which these can be maintained. Science provides the basis for structuring and ordering the social world, similar to the structure and order in the natural world. The methods of natural science are used to generate explanations of the social world. Their approach to social science is rooted in the tradition of positivism.

Functionalists are individualists. That is, the properties of the aggregate are determined by the properties of its units.

The functionalist paradigm has become dominant in academic sociology and mainstream academic finance. The world of finance is treated as a place of concrete reality, the individual is regarded as taking on a passive role; his or her behavior is being determined by the economic environment.

Theories and policies in current mainstream academic finance may be listed<sup>2</sup> as follows: (1) Efficient market theory, (2) Portfolio theory, (3) Capital asset pricing theory, (4) Option pricing theory, (5) Agency theory, (6) Arbitrage pricing theory, (7) Capital budgeting policy, (8) Capital structure policy, and (9) Dividend policy.

Bettner, Robinson, and McGoun (1994) note that the common threads among theories in mainstream academic finance are:

---

<sup>1</sup> See Burrell and Morgan (1979).

<sup>2</sup> For overviews of the finance literature, see Brennan (1995), Smith (1990), and Weston (1994).

1. There is a cause and effect mechanism underlying all nature and human activity (ontology);
2. It is known through the set of nomological connections between initial conditions and final outcomes (epistemology);
3. Human beings interact with each other and their society in accordance with this mechanism (human nature); and
4. Information regarding all natural and human activity can be acquired through observations and measurements unaffected by individual perceptual differences (methodology),<sup>3</sup> (page 3)

which lead to the conclusion that the current theories in finance are clearly based on the functionalist paradigm.

Functionalist paradigm's views with respect to the nature and role of technology are presented next.<sup>4</sup>

Capital goods are heterogeneous commodities due to their different technical characteristics. Capital goods are one of the factors of production. In contrast to labor and land, capital goods are not given, because they are themselves produced. Capital goods are both an output and an input and, therefore, the size and variation of the capital stock are determined endogenously. That is, as a factor of production, capital stock is not a given but it is the result of an economic process in which it participates as one of the determinants. Consequently, the formation of capital stock or investment is the major channel through which all other determinants (such as technical progress, change in labor supply, or the exploitation of natural resources) influence the long-run growth of an economic system.

Classical economists became interested in the analysis of economic growth because of their philosophical concern with growth in national wealth, consumption, and the material basis of society. They regarded the principle of national advantage as an essential criterion of economic policy. Accordingly, their purpose of analysis was to identify the forces in society that promoted or hindered economic growth in order to provide a basis for policy and action to influence those forces.

Classical economists provided an account of the mechanisms underlying the growth process and major forces that influence economic growth. Their important achievement was the recognition that the main driving force behind economic growth is the investment of a part of the social product towards accumulation of capital stock. Such capital accumulation forms as a result of the reinvestment of a portion of profits.

At the core of the problem of economic growth lies the explanation of the forces underlying the process of the accumulation of capital stock. Closely associated with the accumulation of capital stock is the technical change, as expressed in the division of labor and changes in methods of production.

---

<sup>3</sup> See Bettner, Robinson and McGoun (1994) and McGoun (1992) for more complete treatments.

<sup>4</sup> For this literature see Domar (1946), Hahn (1965), Hahn and Matthews (1964), Harrod (1939), Hicks (1965), Kaldor (1956), Mitra (1976), Pasinetti (1981), Robinson (1956, 1962), Solow (1956), Sraffa (1960), Uzawa (1961), and von Neumann (1937). This section is based on New Palgrave Dictionary of Economics.

The most common analysis of the accumulation of capital has viewed the problem as the expansion of the productive potential of an economy with a given technology, which may be improved in the process. This approach leads to analyses based on the idea of steady growth.

Accumulation of capital is the result of plowing back part of the surplus generated from production. Accordingly, accumulation of capital is the investment of part of society's net product – the surplus of output over consumption and the requirements for maintaining the existing capital stock – in order to expand productive capacity to take advantage of new or developing markets. The study of the accumulation of capital in the steady state growth of the economy explains both the availability of the surplus and the motivation for plowing it back.

Most of the modern work studied accumulation of capital in the context of steady growth. Economic growth can have a specific target, or can continue indefinitely. The former is the subject of “turnpike” studies (that is, in order to reach a target set of outputs, first the economy most rapidly shifts to the balanced growth path – the “turnpike” – and grows along it, and changes to the desired set of outputs when it reaches the right size). The latter is the subject of models in which equilibrium paths of perpetual growth are determined and their properties examined. In other words, given a system of production, the above two approaches answer the question how that system can be organized in order to grow either over some finite period of time to reach some target set of outputs or over the indefinite future. In either case the accumulation of capital, which is the core of economic growth, will result from the investment of part of the surplus, and will be analyzed either as a case of steady growth or as a deviation from steady growth.

Classical economists provided a complex structure of ideas expressing a deep understanding of the nature of the economic system, the sources of its expansion, and the barriers or limits to its expansion. However, their ideas were constrained by the conditions of their agrarian economy, i.e., without significant change in methods of production. Without technological progress, the limited quantity and diminishing fertility of the soil results in the limit to growth by increasing the cost of production of agricultural commodities. Their analysis underestimated the role of technological progress in transforming the conditions of productivity both in agriculture and in industry.

Neoclassical economists explicitly incorporate technological progress in their analysis. The neoclassical model determines a path of steady and stable full-employment growth. For example, when the rate of growth of labor, measured in efficiency units (the natural rate of growth), exceeds the rate determined by the propensity to save and the capital-output ratio (the rate that will just balance aggregate demand and aggregate supply), the real wage will tend to fall. This leads firms to substitute labor for capital. Consequently, the capital-output ratio will decline, raising the rate of growth. If the production function is well-behaved (linear and homogeneous, positive first and negative second derivatives, marginal product of capital tends to infinity as capital-labor ratio tends to zero, and tends to zero as capital-labor ratio tends to infinity), then there will exist an equilibrium growth path. Technological progress which leaves the capital-output ratio unchanged (Harrod-neutral) will not affect the steady-growth path; and technological progress which leaves the ratio of the marginal products of capital and labor unchanged (Hicks-neutral) will change the path, but the economy will adjust smoothly to the new equilibrium.

In neoclassical theory, equilibria tend also to be optimal, but in general the steady growth path will not be. Along an optimal path per capita consumption is at a maximum. Consumption is

output minus investment. Investment must grow at a constant rate in order to fully employ the growing labor force. If the marginal product of capital is more than is required to equip the labor force, consumption rises; if it is less, consumption falls. Hence when the marginal product of capital just equals the additional investment required to equip the growing labor force, consumption will be at a maximum. The “Golden Rule of Growth” means consumption per head is maximized and obtains when the rate of profit equals the rate of growth.

### **III. THE INTERPRETIVE PARADIGM**

In Exhibit 1, the interpretive paradigm occupies the southwest quadrant. Schools of thought within this paradigm can be located on the objective-subjective continuum. From left to right they are: Solipsism, Phenomenology, Phenomenological Sociology, and Hermeneutics.

The interpretive paradigm sees the social world as a process which is created by individuals. Social reality, insofar as it exists outside the consciousness of any individual, is regarded as being a network of assumptions and intersubjectively shared meanings. This assumption leads to the belief that there are shared multiple realities which are sustained and changed. Researchers recognize their role within the phenomenon under investigation. The goal of interpretive researchers is to find the orders that prevail within the phenomenon under consideration; however, they are not objective.

The interpretive paradigm believes that in cultural sciences, the subject matter is spiritual in nature. In the cultural sphere, human beings are perceived as free. An understanding of their lives and actions can be obtained by the intuition of the total wholes. Cultural phenomena are seen as the external manifestations of inner experience. The cultural sciences, therefore, need to apply analytical methods based on “understanding;” through which the scientist can seek to understand human beings, their minds, and their feelings, and the way these are expressed in their outward actions.

The interpretive paradigm believes that scientific knowledge is socially constructed and socially sustained; its significance and meaning can only be understood within its immediate social context. Interpretive finance research enables scientists to examine aggregate market behavior together with ethical, cultural, political, and social issues. The interpretive paradigm believes that there are no universally valid rules of finance and financial management.

Interpretive research in academic finance is negligible compared to the functionalist research. The following is a list of examples of interpretive research: Baker (1992), Baker and Wruck (1989), Cray and Haines (1992), Frankfurter and Lane (1992), Kryzanowski and Roberts (1993a, 1993b), Lintner (1956), O’Barr and Conley (1992), and Rosen (1990).

Interpretive paradigm’s views with respect to the nature and role of technology are presented next.<sup>5</sup>

The social construction of technology (SCOT) shows how social processes influence the content of technology, e.g., when a technology is deemed to be working. SCOT illustrates that

---

<sup>5</sup> For this literature see Bijker (1990), Bijker, Hughes, and Pinch (1987), Bijker and Law (1992), Jasanoff, Markle, Petersen, and Pinch (1995), Klein and Kleinman (2002), Pinch (1996), and Pinch and Bijker (1984). This section is based on Klein and Kleinman (2002) and Pinch (1996).

technology and the facts about its working, which are established through processes of engineering design and testing, are social constructs.

The conceptual framework of the social construction of technology (SCOT) consists of five related components.

The first component of the SCOT framework is the *relevant social group*. The understanding of technological development requires the understanding of the technological artifacts, i.e., materials and processes. SCOT, which is fundamentally a sociological approach towards technology, approaches and analyzes artifacts in the context of society. Society is conceptualized and related to artifacts through the notion of relevant social groups. These are social groups who play a role in the development of a technological artifact. Such social groups share a meaning of the artifact. This meaning is then used to explain particular development paths which the artifact takes. Some examples of social groups are as follows: engineers, advertisers, public-interest groups, and consumers. The understanding of a complex technology involves a whole array of such social groups. Although the only defining characteristic of a social group is its homogeneous meaning given to a certain artifact, the intention is not just to make general statements about any of the social groups, such as consumers and producers. For each relevant social group, its detailed description is needed in order to be able to define the functioning of the artifact with respect to that social group.

Relevant social groups have particular interpretations and accordingly all members of a social group share the same set of meanings with respect to a given artifact. In other words, they are the agents in this agency-centered approach whose actions reflect the meanings they associate with specific artifacts. Technological development is a social process which involves multiple social groups, each of which has a specific interpretation of a certain artifact, and they negotiate over its design, with different social groups seeing and constructing quite different technological artifact. For instance, if social groups have different definitions of a working technology, then the technological development continues until all groups come to a consensus that their common artifact works. At this stage, the technological development culminates not because the technological artifact works in some objective sense but because all relevant social groups agree that it works for them.

The second component of the SCOT framework is the *interpretive flexibility*. It means that different social groups may associate radically different meanings to a certain artifact. That is, there is interpretive flexibility with respect to the meaning given to a given artifact. Interpretive flexibility applies to both a compound artifact and to its separate components.

Interpretive flexibility implies that technology design (and use) is an open process that can generate different outcomes depending on the social circumstances in which they are development. That is, technological artifacts are the outcomes of inter-group negotiations. There are several possible outcomes of the design (and use) of technological artifacts, therefore, the final design (and use) that finally results from the process, it could have been different.

The third component of the SCOT framework is the *closure and stabilization*. The involvement of several social groups in the technological design (and use) process can lead to controversies since their different interpretations lead to conflicting images of an artifact. Technological design (and use) continues until such controversies are resolved and the technological artifact is considered satisfactory by all relevant social groups. At this point, the process achieves closure and the artifact stabilizes in its final form. Two examples of closure

mechanisms are as follows. Rhetorical closure involves a declaration that no further problems exist and that no additional design is necessary. Closure by redefinition involves a redefinition of unresolved problems such that they no longer pose problems to all relevant social groups.

Closure and stabilization obtain when an artifact seems to have fewer problems and become increasingly the acceptable and dominant form of the technology. This may not necessarily lead to all competing technological artifacts disappearing, and often two very different technologies may co-exist. Furthermore, the process of closure or stabilization need not necessarily be final. New problems can arise and the interpretive flexibility of the technological artifact can reappear.

The fourth component of the SCOT framework is the *wider context*. This is the wider socio-cultural and political context in which the development of the technological artifact occurs. The background conditions of group interactions, such as their relations to each other, the rules ordering their interactions, and factors contributing to differences in their power fall in this category.

The fifth component of the SCOT framework is the *technological frame*, i.e., frame with respect to technology. This is a social group's shared cognitive frame of reference that forms social group members' common interpretation of a certain artifact. Similar to a Kuhnian paradigm, a technological frame can include goals, key problems, current theories, rules of thumb, testing procedures, and exemplary artifacts that, tacitly or explicitly, structure group members' thinking, problem solving, strategy formation, and design activities. A technological frame usually promotes certain actions and discourages others. In the process, technological frame acts as a frame of meaning with respect to a particular technology which is shared by several social groups, which, in turn, further guides and shapes the development of the artifact. This helps to shed light on how the structured character of the larger social context is linked to technology design (and use).

#### **IV. THE RADICAL HUMANIST PARADIGM**

In Exhibit 1, the radical humanist paradigm occupies the northwest quadrant. Schools of thought within this paradigm can be located on the objective-subjective continuum. From left to right they are: French Existentialism, Anarchistic Individualism, and Critical Theory.

The radical humanist paradigm assumes that reality is socially created and sustained. It provides critiques of the status quo. It tends to view society as anti-human. It views the process of reality creation as feeding back on itself; such that individuals and society are prevented from reaching their highest possible potential. That is, the consciousness of human beings is dominated by the ideological superstructures of the social system, which results in their alienation or false consciousness. This, in turn, prevents true human fulfillment. The social theorist regards the orders that prevail in the society as instruments of ideological domination. The major concern for theorists is with the way such ideological domination occurs and finding ways in which human beings can release themselves. They seek to change the social world through a change in consciousness.

Radical humanists believe that everything must be grasped as a whole, because the whole dominates the parts in an all-embracing sense. Moreover, truth is historically specific, relative to a given set of circumstances, so that one should not search for generalizations for the laws of motion of societies.



The focus of the radical humanists upon the “superstructural” aspects of society reflects their attempt to emphasize the Hegelian dialectics. It is through the dialectic that the objective and subjective aspects of social life interact. The superstructure of society is believed to be the medium through which the consciousness of human beings is controlled and molded to fit the requirements of the social formation as a whole. The radical humanists emphasize the political and repressive nature of purposive rationality, logic of science, positive functions of technology, and neutrality of language.

Radical humanist research in academic finance is non-existent. Examples of radical humanist research, although not even mentioned in academic finance, are: Biewener (1999, 2000), Cullenberg (1994, 1997), Perelman (1987, 1993, 1999), and Tinker, Merino, and Neimark (1982).

Radical humanist paradigm’s views with respect to the nature and role of technology are presented next.<sup>6</sup>

The concept of “rationality” refers to the form of capitalist economic activity, bourgeois private law, and bureaucratic authority. Rationalization means subjecting different areas of society to the criteria of rational decision, i.e., the criteria of instrumental action penetrate into different areas of life. It implies purposive-rational action, which refers to the organization of means of choice between alternatives. In this framework, planning can be regarded as purposive-rational action of the second order. This is because it aims at the establishment, improvement, or expansion of systems of purposive-rational action themselves.

The increasing “rationalization” of society is related to the institutionalization of scientific and technical development. Technology and science progressively permeate social institutions and transform them, and in this way old legitimations are replaced.

The concept of technical reason is ideological. Both the application of technology and technology itself are forms of domination, i.e., domination of nature and domination of men. Technical reason is methodical, scientific, calculated, and calculating control. Specific plans of domination are not superimposed on technology subsequently and externally; they enter *a priori* in the construction of the technical apparatus. Technology is always a historical-social phenomenon, i.e., it shows what a society and its ruling interests intend to do with men and things.

The technological *a priori* is a political *a priori* to the extent that the transformation of nature involves that of man, and to the extent that the man-made creations affect and are affected by their societal ensemble. It might be said that the machinery of the technological universe is indifferent towards political ends. However, when techniques become the universal form of material production, they affect and modify an entire culture; they project a historical totality, i.e., a world.

In the name of rationality, “rationalization” realizes a specific form of unacknowledged political domination. This sort of rationality intends to lead to the correct choice among strategies, the appropriate applications of technologies, and the efficient establishment of systems with presupposed aims in given situations. Therefore, it removes the total social framework of interests in which strategies are chosen, technologies are applied, and systems are

---

<sup>6</sup> For this literature see Feenberg (1991, 1999), Habermas (1970), Heidegger (1977), Lukacs (1971), and Marcuse (1964). This section is based on Habermas (1970).

established, from the scope of reflection and rational reconstruction. This type of rationality intends to lead only to relations of technical control and therefore encourages actions that imply domination, whether of nature or of society. By its very nature, purposive-rational action is the exercise of control. According to this type of rationality, the “rationalization” of society is the institutionalization of a form of domination. However, the political character of this domination becomes unrecognizable. This is despite the fact that the technical reason of a social system of purposive-rational action does not lose its political content.

The institutionalized growth of the forces of production, which surpasses all historical proportions, follows from scientific and technical progress. This gives the institutional framework the opportunity for legitimation. The idea that the objectively superfluous, repressive character of historically obsolete relations of production can be measured against the growth of productive forces is denied because the existing relations of production are the technically necessary organizational form of a rationalized society. The forces of production, at this stage of their scientific-technical development, enter a new arrangement with the relations of production. Growth in the forces of production are not used as the basis of a critique of prevailing legitimations, instead they are used as the basis for legitimation.

The objectively superfluous repression of individuals is experienced in their intensified subjection to the enormous apparatus of production and distribution, and in their de-privatization of free time. Ironically, however, this repression might not register in the consciousness of individuals because the legitimation of domination is based on the growth of the forces of production and the domination of nature which provide individuals with increasingly comfortable lives.

The rationality embodied in the system of purposive-rational action is limited. In addition, the rationality of science and technology, instead of being reducible to unvarying rules of logic and method, is a substantive, historically derived, and transitory *a priori* structure.

Modern science was *a priori* structured in such a fashion that it could serve as conceptual instrument for productive control. Consequently, theoretical operationalism came to correspond to practical operationalism. The scientific method which led to the progressive domination of nature provided the concepts and instrumentalities for the progressive domination of man by man through the domination of nature. Domination is perpetuated and extended not only through technology but as technology. The latter provides the legitimation of the expanding political power, which encompasses all spheres of culture.

Technology rationalizes the unfreedom of man in being autonomous and in determining one's own life. This unfreedom is recognized neither as irrational nor as political, but rather as submission to the technical apparatus which increases the productivity of labor and enlarges the comforts of life. In this way, technological rationality legitimizes domination and opens on a rationally totalitarian society.

The nature of fusion of technology and domination, rationality and oppression is contained in the material *a priori* of the logic of science and technology and determined by class interest and historical situation. Therefore, social emancipation cannot be conceived without a complementary revolutionary transformation of science and technology themselves.

The transcendental framework within which nature would be made the object of a new experience would replace the functional system of instrumental action. The viewpoint of possible

technical control would be replaced by one of preserving, fostering, and releasing the potentialities of nature.

## V. THE RADICAL STRUCTURALIST PARADIGM

In Exhibit 1, the radical structuralist paradigm occupies the northeast quadrant. Schools of thought within this paradigm can be located on the objective-subjective continuum. From right to left they are: Russian Social Theory, Conflict Theory, and Contemporary Mediterranean Marxism.

The radical structuralist paradigm assumes that reality is objective and concrete. It uses scientific methods to find the order that prevails in the phenomenon. It views society as a potentially dominating force.

This paradigm is based on four central notions. First, there is the notion of totality, i.e., the phenomenon as a whole. This notion emphasizes that the totality shapes and is present in all its constituent parts. Second, there is the notion of structure. The focus is upon the configurations of social relationships, called structures. The third notion is that of contradiction. Structures, or social formations, contain contradictory and antagonistic relationships within them which act as seeds of their own decay. The fourth notion is that of crisis. Contradictions within a given totality reach a point at which they can no longer be contained. The resulting political and economic crises indicate the point of transformation from one totality to another, in which one set of structures is replaced by another of a fundamentally different nature.

To survive and reproduce themselves, human beings transform reality, where material reality is the most important. This transformation takes place through the social division of labor. This division implies that social groups enter into relations with each other to produce, while they use means of production, that is, they enter into production relations. These groups, formed in terms of production relations, are called social classes. A complete definition of a social class encompasses economic, political, and ideological elements, with dialectical relationships. Production relations, under capitalism, are antagonistic, since they unite two antagonistic poles, defined as owner and non-owner. Therefore, social classes, who are the carriers of contradictory aspects of social relations, are antagonistic too.

Transforming material requires knowledge of doing it. Gaining knowledge of doing it requires dealing with it, i.e., transforming it. This is the materialist basis of epistemology, i.e., science has a materialist nature. Therefore, only classes, identifiable in terms of production relations, have the objective possibility of an independent knowledge of reality. Furthermore, the class which deals with a larger portion of reality, has the greater objective possibility of gaining a correct knowledge of it. Under capitalism, the proletariat,<sup>7</sup> which deals with an increasing portion of social reality, has the objective possibility of knowing it correctly. In the context of the constant attempt that classes make to dominate each other, it can only realize itself through ideological class struggle. Knowledge is, thus, in the most fundamental sense, ideological, since it formulates views of reality and solves problems from a class point of view.

---

<sup>7</sup> The proletariat is defined as all the individuals who participate in the transformation of material, i.e., in the transformation of the social product, while not owning the means necessary for this transformation.

Radical structuralist research in academic finance is non-existent. The literature in this area has been, historically, quite extensive, although there has been no mention of its existence in academic finance. Some examples of radical structuralist research are: Gill (1999), Magdoff and Sweezy (1987), Sweezy (1964, 1994, 1997), and Sweezy and Magdoff (1972).

Radical structuralist paradigm's views with respect to the nature and role of technology are presented next.<sup>8</sup>

In order to live, people must have food, clothing, footwear, shelter, fuel, etc. In order to have these materials, people must produce them. In order to produce these materials, people must have the instruments of production. People must be able to produce and use these instruments of production. These embody the technology.

The instruments of production and the people who operate them, together with their experience and skill, constitute the *forces of production* of society.

The forces of production are only one aspect of production. Another aspect of production is the *relations of production*, i.e., the relation of men to each other in the process of production. In the production of materials men enter into mutual relations of one kind or another, called relations of production. The relations of production may be free from exploitation, they may be based on domination and subordination, or they may be transitional from one form of relations of production to another.

The relations of production show who owns the *means of production* (the land, forests, waters, mineral resources, raw materials, instruments of production, production premises, means of transportation and communication, etc.), who has command over the means of production, whether the whole of society, or individual persons, or groups, or classes which utilize them for the exploitation of other persons, groups, or classes?

The *mode of production* consists of both the forces of production and the relations of production.

Over time, forces of production develop, most prominently due to the development in technology. At different stages of development of forces of production, societies utilize different modes of production. For instance, different modes of production prevail in the primitive commune, in slavery, in feudalism, in capitalism, or in socialism. A change in the mode of production leads to changes in the whole social system: social ideas, theories, political views, and political.

This means that the history of development of society is above all the history of the development of technology, the history of the development of forces of production, the history of the change in modes of production, which succeed each other in the course of centuries.

The development of instruments of production since the ancient times briefly has been as follows. The development from crude stone tools to the bow and arrow, from the life of hunters to the domestication of animals and primitive pasturage; the development from stone tools to metal tools (the iron axe, the wooden plow fitted with an iron coulter, etc.), and the life of tillage and agriculture; further development in metal tools for the working up of materials, the blacksmith's bellows, the pottery, handicrafts, the separated lines of handicrafts from agriculture, handicraft industry and manufacturing industry; the development from handicraft tools to

---

<sup>8</sup> For this literature see Croce (2000), Engles (1979), Marx (1969), Plekhanov (1969), Schmitt (1987), and Stalin (1940). This section is based on Stalin (1940).

machines, handicraft machine industry and manufacturing machine industry; the development to the machine system, modern large-scale machine industry.

In conformity with the improvement and development of the technology and the forces of production of society in the course of history, men's relations of production also has improved and developed. The five main types of relations of production are primitive communal, slave, feudal, capitalist and socialist.

Development in technology is the most mobile and revolutionary element in production, which determines the development of society. The development and improvement of the instruments of production has been effected by men who were involved in the process of production. Consequently, the improvement and development of the instruments of production has been accompanied by an improvement and development of men. This has taken effect through their production experience, improvement in their labor skill, and improvement in their ability to handle the instruments of production.

Society's development always begins with the development in technology embodied in the instruments of production. This, in turn, leads to the development in the forces of production. Then, in conformity with them, relations of production change. Note should be taken that the relations of production influence the development of the forces of production. That is, relations of production might accelerate or retard the development of the forces of production. The relations of production cannot fall behind and be in a state of contradiction to the growth of the forces of production. Forces of production can develop only when the relations of production correspond to their character. The relations of production must come, and actually do come, into correspondence with the level of development of the forces of production. Otherwise there would be a fundamental violation of the unity of the forces of production and the relations of production within the system of production. This would mean a disruption of production as a whole, a crisis of production, and a destruction of the forces of production.

For instance, in capitalist countries, the relations of production do not correspond to the character of the forces of production. This is because private capitalist ownership of the means of production does not correspond to the social character of the process of production, i.e., with the character of the forces of production. This results in economic crises, which lead to the destruction of productive forces. Furthermore, this incongruity constitutes the economic basis of social revolution, the purpose of which is to destroy the existing relations of production and to create new relations of production which correspond to the social character of the forces of production.

In contrast, in socialism, the relations of production completely correspond to the character of the forces of production. That is, the social ownership of the means of production fully corresponds to the social character of the process of production. Therefore, in socialism, economic crises and the destruction of forces of production are nonexistent.

## **VI. CONCLUSION**

This paper briefly discussed four views expressed with respect to the nature and role of technology. The functionalist paradigm views technology as a factor of production and therefore views technological progress as having corresponding effect on economy's output and growth. The interpretive paradigm views technology as a social construction which should be analyzed

within the larger social process. The radical humanist paradigm views technology as ideology and being used for domination over the majority of people in society. The radical structuralist paradigm views technology as the most revolutionary among the forces of production, whose growth has taken human society from primitive commune, to slavery, to feudalism, to capitalism, and towards socialism.

This paper noted that scientists often approach their subject from a frame of reference based upon assumptions that are taken-for-granted. Since these assumptions are continually affirmed and reinforced, they remain not only unquestioned, but also beyond conscious awareness. In this way, most researchers in academic finance tend to favor the functionalist paradigm and its views with respect to the nature and role of technology.

The partial nature of this view only becomes apparent when the researcher exposes basic assumptions to the challenge of alternative ways of seeing, and starts to appreciate these alternatives in their own terms. To do this, one has to explore other paradigms from within, since the concepts in one paradigm cannot easily be interpreted in terms of those of another. Once each view of technology is seen from within the respective paradigm, all four views of technology are seen to be equally scientific and informative; they look at the nature and role of technology from a certain paradigmatic viewpoint.

The diversity of finance research possibilities referred to in this paper is vast. While each paradigm advocates a research strategy that is logically coherent, in terms of underlying assumptions, these vary from paradigm to paradigm. The phenomenon to be researched can be conceptualized and studied in many different ways, each generating distinctive kinds of insight and understanding. There are many different ways of studying the same social phenomenon, and given that the insights generated by any one approach are at best partial and incomplete, the social researcher can gain much by reflecting on the nature and merits of different approaches. It is clear that social scientists, like other generators of knowledge, deal with the realization of possible types of knowledge, which are connected with the particular paradigm adopted.

The paper, therefore, recommends a serious conscious thinking about the social philosophy upon which finance, in general, and technology research, in particular, is based and of the alternative avenues for development. The knowledge of the four paradigms is of paramount importance to any scientist, because the process of learning about a favored paradigm is also the process of learning what that paradigm is not. The knowledge of paradigms makes scientists aware of the boundaries within which they approach their subject. Each of the four paradigms implies a different way of social theorizing in general, and finance and technology, in particular.

Academic finance, in general, and technology researchers, in particular, can gain much by exploiting the new perspectives coming from other paradigms. An understanding of different paradigms leads to a better understanding of the multi-faceted nature of finance and technology. Although a researcher may decide to conduct research from the point of view of a certain paradigm, an understanding of the nature of other paradigms leads to a better understanding of what one is doing.

Knowledge of finance and technology is ultimately a product of the researcher's paradigmatic approach to this multifaceted phenomenon. Viewed from this angle, the pursuit of financial and technological knowledge is seen as much an ethical, moral, ideological, and political activity, as it is a technical one.

**REFERENCES**

- Ardalan, K., 2007a, "Corporate Governance: A Paradigmatic Look," *International Journal of Social Economics*, Vol. 34, No. 8, August, pp. 506-524.
- Ardalan, K., 2007b, "Markets: A Paradigmatic Look," *International Journal of Social Economics*, Vol. 34, No. 12, pp. 943-960.
- Baker, G., 1992, "Beatrice: A Case Study in the Creation and Destruction of Value," *Journal of Finance*, pp. 1081-1120
- Baker, G. and Wruck, K., 1989, "Organization Changes and Value Creation in Leveraged Buyouts: The Case of O.M. Scott & Sons Co.," *Journal of Financial Economics*, pp. 163-90.
- Bettner, M.S., Robinson, C. and McGoun, E., 1994, "The Case for Qualitative Research in Finance," *International Review of Financial Analysis*, pp. 1-18.
- Biewener, C., 1999, "The Promise of Finance: Banks and Community Development," In Baiman, R., Boushey, H. and Saunders, D., (eds.), *Political Economy and Contemporary Capitalism: Radical Perspectives on Economic Theory and Policy*, Armonk, NY: M.E. Sharpe.
- Biewener, C., 2000, "The Promise of Finance: Banks and Community Development," In Gibson-Graham, J.K., Resnick, S. and Wolff, R., (eds.), *Re/presenting Class: Essays in Postmodern Political Economy*, forthcoming, North Carolina: Duke University Press.
- Bijker, W.E., 1990, *The Social Construction of Technology*, the Netherlands: Eijdsden.
- Bijker, W.E., T.P. Hughes, and T.F. Pinch, 1987, *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, Cambridge, Massachusetts: M.I.T. Press.
- Bijker, W.E. and J. Law, 1992, *Shaping Technology/Building Society: Studies in Socio-Technical Change*, Cambridge: M.I.T. Press.
- Brennan, M.J., 1995, "Corporate Finance over the Past 25 Years," *Financial Management*, pp. 9-22.
- Burrell, G. and Morgan, G., 1979, *Sociological Paradigms and Organizational Analysis*, Hants, England: Gower Publishing Company Limited.
- Cray, D. and Haines, G., 1992, "Do as I Say, Not as You Do: Prescriptive and Descriptive Models of Decision Making in Pension Fund Management," Working Paper, Carleton University School of Business, Ottawa, Canada.
- Croce, B., 2000, *Historical Materialism and the Economics of Karl Marx*, translated by C.M. Meredith, Whitefish, MT: Kessinger Publishing.
- Cullenberg, S.E., 1994, *The Falling Rate of Profit: Recasting the Marxian Debate*, London: Pluto Press.
- Cullenberg, S.E., 1997, "Decentering the Marxian Debate over the Falling Rate of Profit: A New Approach," In Riccardo Bellofiore, (ed.), *Marxian Economics: Prices, Profits, and Dynamics*, Macmillan.
- Cullenberg, S.E., 2000, "Falling Profits, Fallen Theories? Recasting the Marxian Debate over the Falling Rate of Profit," *Rethinking Marxism*, forthcoming.
- Domar, E.D., 1946, "Capital Expansion, Rate of Growth and Employment," *Econometrica*, 14, 137-147.
- Engels, F., 1979, *On Historical Materialism*, New York: AMS Press.

- Feenberg, A., 1991, *Critical Theory of Technology*, New York and Oxford: Oxford University Press.
- Feenberg, A., 1999, *Questioning Technology*, Amsterdam.
- Frankfurter, G.M. and Lane, W.R., 1992, "The Rationality of Dividends," *International Review of Financial Analysis*, pp. 115-129.
- Gill, S. "The Geopolitics of the Asian Crisis," *Monthly Review*, 1999, pp. 1-9
- Habermas, J., 1970, *Toward a Rational Society: Student Protest, Science, and Politics*, Boston: Beacon Press.
- Hahn, F.H., 1965, "On Two-Sector Growth Models," *Review of Economic Studies*, 32(4), 339-346.
- Hahn, F.H. and Matthews, R.C.O., 1964, "The Theory of Economic Growth: A Survey," *Economic Journal*, 74, 779-902.
- Harrod, R.F., 1939, "An Essay in Dynamic Theory," *Economic Journal*, 49, 14-33.
- Heidegger, M., 1977, *The Question Concerning Technology*, New York: Harper Colophon Books.
- Hicks, J., 1965, *Capital and Growth*, Oxford: Oxford University Press.
- Jasanoff, S., G.E. Markle, J.C. Petersen, and T. Pinch, (eds.), 1995, *Handbook of Science and Technology Studies*, Thousand Oaks: Sage Publications.
- Kaldor, N., 1956, "Alternative Theories of Distribution," *Review of Economic Studies*, 23, 83-100.
- Klein, H.K. and D.L. Kleinman, 2002, "The Social Construction of Technology: Structural Considerations," *Science, Technology, & Human Values*, 27(1), Winter, 28-52.
- Kryzanowski, L. and Roberts, G., 1993a, "Canadian Banking Solvency, 1922-1940," *Journal of Money, Credit and Banking*.
- Kryzanowski, L. and Roberts, G., 1993b, "Capital Forbearance: A Depression Era Case Study of Sun Life," Working Paper, Concordia University, Canada.
- Lintner, J., 1956, "Distribution of Income of Corporations Among Dividends, Retained Earnings, and Taxes," *American Economic Review*, pp. 97-113.
- Lukacs, G., 1971, *History and Class Consciousness: Studies in Marxist Dialectics*, Cambridge, Mass.: MIT Press.
- Magdoff, H. and Sweezy, P.M., 1987, *Stagnation and the Financial Explosion*, New York: Monthly Review Press.
- Marcuse, H., 1964, *One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society*, Boston: Beacon Press.
- Marx, K., 1969, "Preface to a Contribution to the Critique of Political Economy," in K. Marx and F. Engels, *Selected Works: In Three Volumes, Volume 1*, pp. 502-506.
- McGoun, E.G., 1992, "On Knowledge of Finance," *International Review of Financial Analysis*, pp. 161-177.
- Mitra, T., 1976, "On Efficient Capital Accumulation in a Multi-Sector Neoclassical Model," *Review of Economic Studies*, 43, 423-429.
- O'Barr, W. and Conley, J., 1992, *Fortune & Folly*, Homewood, IL: Richard D. Irwin.
- Pasinetti, L.L., 1981, *Structural Change and Economic Growth: A Theoretical Essay on the Dynamics of the Wealth of Nations*, Cambridge: Cambridge University Press.
- Perelman, M., 1987, *Marx's Crises Theory: Labor, Scarcity, Finance*, New York: Praeger.



- Perelman, M., 1993, "The Qualitative Side of Marx's Value Theory," *Rethinking Marxism*, pp. 82-95.
- Perelman, M., 1999, "Marx, Devalorisation, and the Theory of Value," *Cambridge Journal of Economics*, pp. 719-728.
- Pinch, T.J., 1996, "The Social Construction of Technology: A Review," in R. Fox, (ed.), *Technological Change: Methods and Themes in the History of Technology*, Canada: Harwood Academic Publishers, pp. 17-35.
- Pinch, T.J. and W.E. Bijker, 1984, "The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology Technology Might Benefit Each Other," *Social Studies of Science*, 14(3), August, 399-441.
- Plekhanov, G.V., 1969, *Fundamental Problems of Marxism*, New York: International Publishers.
- Robinson, J., 1956, *The Accumulation of Capital*, London: Macmillan.
- Robinson, J., 1962, *Essays in the Theory of Economic Growth*, London: Macmillan.
- Rosen, M., "Staying on the String: The Yo and the Market in Eighty-Nine," *Critical Perspectives on Accounting*, 1990, 337-65
- Schmitt, R., 1987, *Introduction to Marx and Engels: A Critical Reconstruction*, Boulder and London: Westview Press.
- Smith, Jr., C.W., 1990, "Introduction," In Smith, Jr., C.W., (Ed.), *The Modern Theory of Corporate Finance*, Second Edition, McGraw-Hill Publishing Company.
- Solow, R., 1956, "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics*, 70, 65-94.
- Sraffa, P., 1960, *Production of Commodities by Means of Commodities: Prelude to a Critique of Economic Theory*, Cambridge: Cambridge University Press.
- Stalin, J., 1940, *Dialectical and Historical Materialism*, New York: International Publishers.
- Sweezy, P.M., 1964, *The Theory of Capitalist Development: Principles of Marxian Political Economy*, New York: Monthly Review Press.
- Sweezy, P.M., 1994, "The Triumph of Financial Capital," *Monthly Review*, pp. 1-11.
- Sweezy, P.M., 1997, "More (or Less) on Globalization," *Monthly Review*, pp. 1-4.
- Sweezy, P.M. and Magdoff, H., 1972, *The Dynamics of U.S. Capitalism: Corporate Structure, Inflation, Credit, Gold, and the Dollar*, New York: Monthly Review Press.
- Tinker, A.M., Merino, B.D. and Neimark, M.D., 1982, "The Normative Origins of Positive Theories: Ideology and Accounting Thought," *Accounting, Organizations and Society*, pp. 167-200.
- Uzawa, H., 1961, "On a Two-Sector Model of Economic Growth," *Review of Economic Studies*, 24, 40-47.
- Von Neumann, J., 1937, "A Model of General Economic Equilibrium," *Review of Economic Studies*, 13, 1-9.
- Weston, J.F., 1994, "A (Relatively) Brief History of Finance Ideas," *Financial Practice and Education*, pp. 7-26.

**CONTACT INFORMATION:**

Kavous Ardalan

School of Management

Marist College

Poughkeepsie, New York 12601-1387

Fax: (845) 575-3640

Tel: (845) 575-3000 Ext.2989

E-Mail: [Kavous.Ardalan@marist.edu](mailto:Kavous.Ardalan@marist.edu)