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KNOWLEDGE AS A CAPACITY FOR ACTION

Nico Stehr

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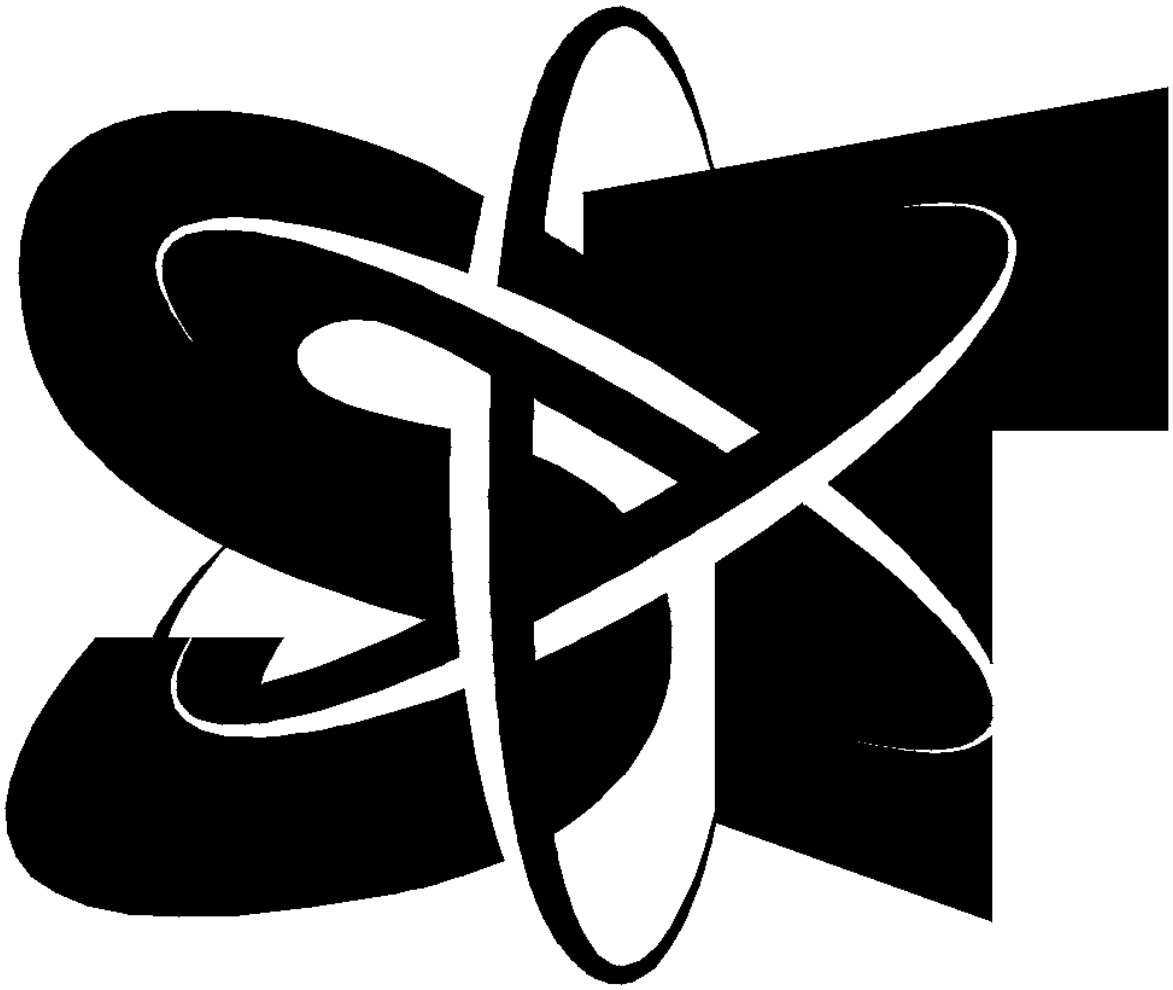

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Knowledge as a Capacity for Action

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THE INFORMATION SYSTEM FOR SCIENCE AND TECHNOLOGY PROJECT

The purpose of this project is to develop useful indicators of activity and a framework to tie them together into a coherent picture of science and technology in Canada.

To achieve the purpose, statistical measurements are being developed in five key areas: innovation systems; innovation; government S&T activities; industry; and human resources, including employment and higher education. The work is being done at Statistics Canada, in collaboration with Industry Canada, and with a network of contractors.

Prior to the start of this work, the ongoing measurements of S&T activities were limited to the investment of money and human resources in research and development (R&D). For governments, there were also measures of related scientific activity (RSA) such as surveys and routine testing. These measures presented a limited and potentially misleading picture of science and technology in Canada. More measures were needed to improve the picture.

Innovation makes firms competitive and more work has to be done to understand the characteristics of innovative, and non-innovative firms, especially in the service sector which dominates the Canadian Economy. The capacity to innovate resides in people and measures are being developed of the characteristics of people in those industries which lead science and technology activity. In these same industries, measures are being made of the creation and the loss of jobs as part of understanding the impact of technological change.

The federal government is a principal player in science and technology in which it invests over five billion dollars each year. In the past, it has been possible to say how much the federal government spends and where it spends it. The next report, to be released early in 1997, will begin to show what the S&T money is spent on. As well as offering a basis for a public debate on the priorities of government spending, all of this information will provide a context for reports of individual departments and agencies on performance measures which focus on outcomes at the level of individual projects.

By the final year of the Project in 1998-99, there will be enough information in place to report on the Canadian system on innovation and show the role of the federal government in that system. As well, there will be new measures in place which will provide a more complete and realistic picture of science and technology activity in Canada.

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Abstract

Contemporary society may be described as a knowledge society based on the penetration of all its spheres of life by scientific knowledge. Many theories of society have always assigned decisive importance to the forces or means of production for societal development. The knowledge referred to in these theories, and the groups of individuals which acquire influence and control with it, tends to be conceptualized rather narrowly. Paradoxically perhaps, there is a tendency to overestimate the efficacy of "objective" technical-scientific or formal knowledge. Theories of modern society lack sufficient detail and scope in their conceptualization of the "knowledge" supplied, the reasons for the demand of more and more knowledge, the ways in which knowledge travels, the rapidly expanding groups of individuals in society who, in one of many ways, live off knowledge, the many forms of knowledge which are considered as pragmatically useful, and the various effects which knowledge may have on social relations.

The emergence of knowledge societies signals first and foremost a radical transformation in the structure of the economy. Productive processes in industrial society are governed by a number of factors, which appear to be on the decline in their significance as conditions for the possibility of a changing, particularly growing economy: The dynamics of the supply and demand for primary products or raw materials; the dependence of employment on production; the importance of the manufacturing sector which processes primary products; the role of labor (in the sense of manual labor) and the social organization of work; the role of international trade in goods and services; the function of time and place in production and of the nature of the limits to economic growth. The most common denominator of the changes in the structure of the economy seems to be a shift from an economy driven and governed, in large measure, by "material" inputs into the productive process and its organization to an economy in which transformations in productive and distributive processes are determined much more by "symbolic" or knowledge based inputs.

The paper deals with ways in which "knowledge" in distinction to information and other media for example is best conceptualized in this new context.

Preface and Overview

There should be a new agenda for social science today because the age of labor and property is at an end. Contemporary **science is** not merely, as was once widely thought, the key to the mysteries of the world, but is **the becoming of a world**.

My remarks this afternoon on "knowledge as a capacity for action" involve comments on the following matters and are divided as follows:

First, I will explicate the thesis that we are on the verge of moving toward a **knowledge society**. From time to time, I will add footnotes in the form brief of explications that should shed some light on conclusions that may be less than obvious to you given my disciplinary perspective. Such a note concerns for example the choice of the term "knowledge society" rather than "post-industrial, post-modern or information society".

Second, I plan to make a few general remarks about the **genealogy of the term knowledge** in social science discourse and advance some ideas,

Third, toward what I consider to be a more appropriate conception of **knowledge -- as a capacity for action** -- in social life. Since science constitutes the most relevant source of knowledge in modern society, I will suggest,

Fourth, that scientific knowledge in this century has evolved into an **immediately productive form of knowledge**.

Fifth, I will offer some observations about **knowledge as commodity** and possible reasons for the growing supply and demand of knowledge.

Finally, a discussion of the interrelation of **knowledge and information** provides me with an opportunity to summarily rehearse some of the comments I have made about the role of knowledge in social affairs.

1. Introduction: Knowledge Societies

Among the most serious general theoretical deficiency of existing theories of modern society which I take to include theories of the modern economy that assign a central role to knowledge is their rather undifferentiated treatment of the key ingredient, namely knowledge itself. The crucial importance assigned to knowledge within these theories has not been matched by extended and enlightened discussions of the concept of knowledge. Our knowledge about knowledge is, in many ways, not very sophisticated .

I have attempted to argue elsewhere that we are in the midst of moving from an industrial society to a knowledge society. Forms of knowledge that science makes available dramatically enlarge the available options of social action.

As a first **footnote**, this observation may not sound all that novel. But one has to be reminded that many radical, liberal and conservative social theorists have been fascinated and concerned about the opposite impact of science and technology on society, namely the extent to which science and technology invariably become an instrument of the powerful and is employed as an agent of control, manipulation and repression. The notion of the technical state as developed just a few years ago by Herbert Marcuse or Helmet Schelsky for example are excellent exemplar of the typical treatment of the social role of science and technology in social science.

The economy of industrial society is initially and primarily a material economy and then changes gradually to a monetary economy; for example, Keynes' economic theory reflects this transformation of the economy of industrial society into an economy affected to a considerable extent by monetary matters. But as more recent evidence indicates, the economy Keynes' described now becomes a (non-monetary) symbolic economy. The changes in the structure of the economy and its dynamics are increasingly a reflection of the fact that knowledge becomes the leading dimension in the productive process, the primary condition for its expansion, for competitive advantages within and among societies, and for a change in the limits to economic growth in OECD countries.

In the production of goods and services, with the exception of the most standardized commodities and services, factors other than the amount of labor time or the amount of physical capital become increasingly central. Mind not muscle tools count although the importance of knowledge is not confined to production alone. In any event, I would argue that we need to focus on the peculiar nature and function of knowledge in economic relations.

Of course, knowledge has always had a function in social life; as a matter of fact, one could speak justifiably of an anthropological constant: Human action is knowledge based. Social groups and social roles of all types depend on, and are mediated by, knowledge. Relations among individuals are based on knowledge of each other. Similarly, power has frequently been based on advantages in knowledge, not only on physical strength. And, last but not least, societal reproduction is not merely physical reproduction but always cultural, i.e. reproduction of knowledge. [1] Contemporary society may be described as a knowledge society based on the penetration of all its spheres of life by scientific knowledge.

Matters in social science, however, are far from promising because the disparaging observation by George Stigler (1961:213) some 25 years ago is still close to the mark: "One should hardly have to tell academicians that information is a valuable resource: knowledge is power. And yet it occupies a slum dwelling in the town of economics." Knowledge is a residual, even invisible component of production and assets. Knowledge has many "qualitative" components but quality has not yet prospered within economic discourse. Despite its apparent ascent as a source of added economic value and competitive advantages knowledge remains elusive. Maybe I can offer some conceptual observations and distinctions that make matters a bit less nebulous. Toward this end, I turn to some general comments about our knowledge about knowledge.

2. Knowledge conceptions

Scientific discourse developed a kind of taken-for-granted attitude toward its own knowledge. For this reason, the number of well explicated categories of knowledge has been fairly limited. We really have not moved much beyond the proposals about different forms of knowledge first found in Max Scheler's ([1925] 1960) contributions to the sociology of knowledge in the 1920s, namely the distinction (1) knowledge of salvation (Erlösungswissen), (2) cultural knowledge, or knowledge of pure essences (Bildungswissen) and (3) knowledge that produces effects (Herrschaftswissen). However, the most widely employed conceptions of different forms of knowledge are dichotomies. Dominant is of course the distinction between scientific and non-scientific knowledge.

Even those who have elevated knowledge to the new axial principle of modern society, as has Daniel Bell with his notion of a post-industrial society, treat knowledge as a black box. (As a **footnote** I find the term less useful since it conveys the impression that manufacturing looses its economic importance; this is not the case. As a matter of fact value added in manufacturing is amazingly stable during this century)

3. Toward a sociological concept of knowledge

For the purpose of a further explication of the concept of knowledge, one must distinguish between what is known, the content of knowledge, and knowing. Knowing is a relation to things and facts, but also to rules, laws and programs. Some sort of participation is therefore constitutive for knowing: knowing things, rules, programs, facts is "appropriating" them in some sense, including them into our field of orientation and competence. The intellectual appropriation of things can be made independent or objective. That is, symbolic representation of the content of knowledge eliminates the necessity to get into direct contact with the things themselves (cf. also Collins, 1993). The social significance of language, writing, printing, data storage etc. is that they represent knowledge symbolically or provide the possibility of objectified knowledge. Most of what we today call knowledge and learning is not direct knowledge of facts, rules, and things but objectified knowledge. Objectified knowledge is the highly differentiated stock of intellectually appropriated nature and society that constitutes the cultural resource of a society. Knowing is, then, grosso modo participation in the cultural resources of society. However, such participation is of course subject to stratification; life chances, life style and social influence of individuals depend on their access to the stock of knowledge at hand.

Knowledge is a most peculiar entity with properties generally unlike those of commodities or secrets, for example. If sold, it enter other domains and yet remains within the domain of their producer. Knowledge does not have zero-sum qualities. Knowledge is a public as well as private good. When revealed, knowledge does not lose its influence. While it has been understood for some time that the "creation" of knowledge is fraught with uncertainties, the conviction that its application is without risks and that its acquisition reduces uncertainty has only recently been debunked. It is reasonable to speak of limits to growth in many spheres and resources of life, but the same does not appear to hold for knowledge. Knowledge has virtually no limits to its growth.

Knowledge is often seen as a collective commodity par excellence; for example, the ethos of science demands that it is supposed to be made available to all, at least in principle. But is the "same" knowledge available to all? Is scientific knowledge when transformed into technology still subject to the same normative conventions? The answer one economist provides, is that technology at least must be considered a "private capital good". In the case of technology, the argument goes, disclosure is not the rule and rents for its use can be privately appropriated (cf. Dasgupta, 1987:10). But the apparently unrestricted potential of its availability, which does not affect its meaning, makes knowledge, in peculiar and unusual ways, resistant to private ownership (Simmel, [1907] 1978:438). Modern communication technologies ensure that access becomes easier, and may even subvert remaining proprietary restrictions; however, concentration rather than dissemination is also possible and certainly feared by some including the late Marshall McLuhan. But one could just as easily surmise that the increased social importance of knowledge may in fact undermine the exclusiveness of knowledge. Yet the opposite appears to be the case and therefore raises anew the question of the persisting basis for the power of knowledge. Despite its reputation, knowledge is virtually never uncontested. In science, its contestability is seen as one of its foremost virtues. In practical circumstances, the contested character of knowledge is often repressed and/or conflicts with the exigencies of social action.

4. Knowledge as a capacity for action

In order to shed some light of these questions, I would like to define knowledge as a capacity for action. [2] More specifically, my choice of terms derives from Francis Bacon's famous observation "scientia est potentia" or as it has often been translated in a somewhat misleading fashion: Knowledge is power. Bacon suggests that knowledge derives its utility from its capacity to set something in motion. The term potentia, that is, capacity is employed to describe the power of knowing. [3]

The definition of knowledge as a capacity for action has a number of advantages. For example, it enables one to stress not merely one-sided but multifaceted consequences of knowledge for action. [4] The term capacity for action signals that knowledge may be left unused [5] or may be employed for irrational ends. [6] The definition of knowledge as a capacity for action indicates strongly that the material realization and implementation of knowledge is dependent on, or embedded within the context of specific social, economic and intellectual conditions. Knowledge, as a capacity for action, does not signal that specific knowledge claims always convey or carry a kind of constant and fixed "value".[7] In as much as the realization of knowledge is dependent on the active elaboration of knowledge [8] within specific social conditions, a first link between knowledge and social power becomes evident because the control of the relevant conditions and circumstances requires social power. The larger the scale of the project, the greater the need for social power in order to ensure control over conditions for the realization of knowledge as a capacity for action. While it may be possible at this juncture to build a nuclear generating station in say Indonesia, the same cannot be said for Austria or Germany.

Obviously, scientific and technical knowledge represent such "capacities for action". But this does not mean to repeat that scientific knowledge should be seen as a resource which lacks contestability, is not subject to interpretation and can be reproduced at will. [9]

Knowledge need not be perishable. In principle, a consumer or purchaser of knowledge may use it repeatedly at diminishing or even zero cost. What counts in the sense of gaining advantages in societies which operate according to the logic of economic growth, is access to and command of the marginal additions to knowledge and not the generally available stock of knowledge.

The special importance of scientific and technical knowledge in modern society derives from the fact that it produces incremental capacities for social and economic action or an increase in the ability of "how-to-do-it" which may be "privately appropriated", if only temporarily. [10] And contrary to neo-classical assumptions, the unit price for knowledge-intensive commodities and services decreases with increased production reflecting "progress down the learning curve" (cf. Schwartz, 1992).

Knowledge constitutes a basis for power. As Galbraith (1967:67) stresses, for example, power "goes to the factor which is hardest to obtain or hardest to replace ... it adheres to the one that has greatest inelasticity of supply at the margin." But knowledge as such is not really a scarce commodity, though two features of certain knowledge claims may well transform knowledge from a plentiful into a scarce resource:

(1) What is scarce and difficult to obtain is not access to knowledge per se but to incremental knowledge, to a "marginal unit" of knowledge. The greater the tempo with which incremental knowledge ages or decays, the greater the potential influence of those who manufacture or augment knowledge, and correspondingly, of those who transmit such increments;

(2) If sold, knowledge enters the domain of others, yet remains within the domain of the producer, and can be spun off once again. This signals that the transfer of knowledge does not necessarily include the transfer of the cognitive ability to generate such knowledge, for example, the theoretical apparatus or the technological regime which yields such knowledge claims in the first place and on the basis of which it is calibrated and validated. Cognitive skills of this kind, therefore, are scarce.

The progressive elimination of time and space as relevant elements in the production of knowledge has paradoxically injected the importance of time and location in the interpretation or use of knowledge. Since the validation process of knowledge cannot refer back, except in rare circumstances, to the original author of the claim, the interpretative tasks carried out by "experts" becomes crucial.

In other words, knowledge has to be made available, interpreted and linked to local circumstances. This is the job performed by experts, counselors and advisors. The group of occupations designated here -- for lack of a better term -- as counselors, advisers, and experts is required to mediate between the complex distribution of changing knowledge and those who search for knowledge because "ideas travel" as "baggage" of people whereas skills are embodied in people. A chain of interpretations must come to an "end" in order for knowledge to become relevant in practice and effective as a capacity of action. This function of ending reflection for the purpose of action is largely performed by experts in modern society.

5. Science as an immediately productive force

Science and technology began as a marginal enterprise of amateurs in the seventeenth century; but modern science, especially after World War II, constitutes an immediately productive force.

The changes of the role of science in society take place in three steps.

First, and up to the end of the 18th century the scientific community had the function of enlightenment, that is, it was a producer of meaning or world views.

Second, in the following century -- during the emergence of industrial society -- science became a productive force. Science becomes a productive force in as much as it is frozen into machines. The change from functioning as a producer or critic of meaning to functioning as a productive force means that important aspects of science are now part of the material basis of society. However, as pure science which evolves during this century as well, it is not a productive force.

And, **third**, during the latter part of this century science increasingly becomes without loosing its other functions an immediately productive or "performative" force.

Science prior to the nineteenth century was not mature enough to be applied to problems of production because the material appropriation of nature in the sense of efficient control over boundary conditions or production of pure materials was not developed far enough to enable a realization of scientific results in dimensions relevant for production. A change in the material and cognitive appropriation of nature in the nineteenth century turns science into a productive force and assists society to evolve into industrial society.

I like to explicate this notion by way of a brief **note:** The material appropriation of nature aided by science means more specifically that nature is gradually transformed into a human product by superimposing a new structure, namely a social structure. The social structure in essence is objectified knowledge, that is, an explication and realization of what we know are the laws of nature extended by engineering design and construction. Nature scarcely is experienced otherwise than as a human product or within human products. Because the appropriation of nature is driven by science, scientific knowledge attains a preeminent position in society. Scientific knowledge as productive knowledge becomes the dominant type of knowledge.

In this century, science becomes an immediately productive force. "Immediacy" means that science now may, contrary to the relation between production and science in the nineteenth century, be relevant for production without being mediated by living, that is, corporeal labor. Hence one might be able to speak about the possible abolition of manual labor, especially of factory labor which requires strength and physical dexterity, and the exterritorization of human labor from production into that of the preparation and organization of production. Science produces society directly. Most of the knowledge produced and employed in production no longer is embodied in machines. This transformation extends to diffusion patterns of technology, the decisions affecting the location of production, the interrelation between organizational structures and labor, patterns of conflict and co-operation, comparative advantages and the mounting contingency of economic activity. [11]

Science is an immediately productive force because science increasingly produces action knowledge, that is, data and theories, or better, data and programs. A considerable part of the total work within advanced societies takes place on the metalevel; it is second level production.

Production to a large extent is not metabolism with nature any longer, that is, material appropriation typical of industrial society. Part of production presupposes that nature already is materially appropriated; it consists in rearranging appropriated nature according to certain programs and designs. The "laws" which govern the appropriation of appropriated nature, or secondary production are not the laws of nature but the rules of social constructs. The consequence is that new disciplines emerge whose output serves as an immediately productive force, e.g. operations research and programming, computer science etc. The production of data and systems is immediately productive because it tends to reproduce the knowledge structure of society. The outcome of these developments is also that scientific knowledge in the sense of an immediate productive force becomes a societal resource with functions comparable to those of labor in the productive process. But unlike labor under capitalism, the owners of the resource "knowledge" in a knowledge society acquire power and influence because owners of capital cannot, as was still the case for corporal labor, reduce its content in production through substitution of capital; at best, knowledge can be substituted through other knowledge. Notwithstanding the mechanization of brain work, there also always remains an irreducible amount of "personal knowledge", which can be converted into and valued as "intellectual" or "cultural" capital.

6. The political economy of knowledge: Knowledge as a commodity

Under the heading of the political economy of knowledge, I would like to discuss two items, the threat that we are witnessing the emergence of a "knowledge class" and the notion that knowledge constitutes a commodity just like any other economic commodity.

In the view of some social theorists, the political economy of modern societies extends to the possibility that knowledge becomes the basis for class formation. I will restrict my observations about social inequality and knowledge to a few comments mainly intended to express skepticism toward the notion that we are witnessing the emergence of a "knowledge class" in modern society. Peter Berger (1987:66) for example has recently argued that the modern middle class increasingly is divided into the old middle class consisting of the "business community and its professionals as well as clerical affiliates" and the newer part, namely the "knowledge class". Berger refers in an affirmative sense to Helmut Schelsky's description of the emerging group of knowledge-producers and knowledge-disseminators as the class of the "distributors and mediators of meaning and purposes" (Sinn- und Heilsvermittler).

Individuals who are in the business of distributing and disseminating knowledge -- the group of counselors, advisors and experts as I will call them latter -- are by no means confined to the membership in the "middle class". Moreover, the probability that this stratum develops a "class consciousness", or in fact has an incipient class consciousness, is remote.

It would appear to be almost self-evident that in a society in which knowledge becomes the dominant productive force that knowledge turns into a commodity and can be appropriated, recognized and treated as property. [12] Although knowledge as such is not scarce, certain categories of knowledge have always had their price and were never available in an unlimited supply. However, what precisely determines the value of knowledge is by no means self-evident.

[13] The value of knowledge depends, for example, not merely on the utility it may represent to some individual or firm but is linked to the ability or inability of other actors, for example competitors, to utilize and exploit it to their advantage as well. In the context of traditional economic discourse, knowledge is treated in a peculiar and often less than plausible fashion ranging from assuming "perfect" knowledge of market participants to treating knowledge merely as an exogenous dimension or efforts to argue that knowledge can be treated in a reductionist manner, that is, as a conventional economic category to which orthodox concepts such as utility, fixed and variable costs apply with benefit and without restriction. [14]

As I have indicate already, in economic settings, incremental knowledge has particular importance as a source of added value. If knowledge is power, it most likely is power as the result of control over incremental or additional knowledge. In other words, the strategic importance of incremental knowledge in economic contexts derives from the ability of private firms to temporarily appropriate the marginal additions to knowledge and therefore the economic advantages which may accrue from the control over such knowledge. [15]

The fact that knowledge is treated as a commodity and is traded is not a new phenomenon. [16] None the less, we are still without an economic theory of knowledge. The development of an economic theory of knowledge is by no means an easy task; for one thing, knowledge is, as I have argued, inherently a collective, rather than primarily a private good or property. Knowledge is embedded in social relations. [17] "Knowledge is not, like so many other goods, diminished, decreased in value, or consumed in the process of exchange (cf. Holzner and Marx, 1979:239; also Georg Simmel ([1907] 1978:438). The absence of any ready ways of dividing (in theory and practice) knowledge into "units" has perhaps also limited the enthusiasm of economists to treat knowledge as a commodity among other commodities (cf. Boulding, 1996).

For the most part, the actual possession and legal definition of property is exclusive: "A thing over which I exercise the right of property is --(as Emile Durkheim put it) -- a thing which serves myself alone" (Durkheim, [1950] 1992:141). The exclusive legal command and personal possession of knowledge or a kind of isolation of knowledge as an object is much more difficult to realize if possible at all. However, the legal system has provisions and presumably may evolve others in the future that give certain forms of knowledge an apparently exclusive status.

Most importantly, the (meta)-capacity to generate new increments of knowledge -- which most likely confers comparative advantages -- is not a public good. Knowledge is neither strictly comparable to property nor is without attributes which move it, under certain conditions, nearer to property and commodities. [18]

7. The growing supply of and demand for knowledge

How does one account for the growth of knowledge and, by the same token, how does one explain the apparently unrelenting demand for knowledge, especially in the area of production? On the surface, answers typically point to the inherent logic of scientific and technical progress as the reason for the growth of knowledge while the demand for knowledge is seen as driven by socio-economic and socio-political requirements and needs.

Daniel Bell (1973:26) for example suggests that "a modern society, in order to avoid stagnation or 'maturity' ..., has had to open up new technological frontiers in order to maintain productivity and higher standards of living ... Without new technology, how can growth be maintained?" Bell's assertion agrees that the reasons for the rise of knowledge are essentially utilitarian. In that sense, contemporary society represents an extension of industrial society.

The discussion of knowledge within economic discourse is similar. I will concentrate on the ways in which investments are defined and measured. The typical definition of an investment limits such expenditures to tangible capital, that is, to either machinery or physical plants. Knowledge cannot be an investment unless it is embedded in tangible capital. Knowledge when frozen into machinery is an investment. Within conventional national accounting schemes, if I see this correctly, expenditures for research and development, for training and the purchase of certain types of services do not constitute an investment component. It follows that the purchase of a personal computer or acquisition of the hardware by a business represents a capital investment while the purchase of the requisite software, perhaps a program tailored to the needs of the company and possibly much more expensive than the machine(s) itself, is considered a cost of doing business and not an investment. Such a differentiation is a striking anomaly. The expenditures of individuals and corporation for advice, counseling and expertise also is growing at a rapid rate; however, such services are not treated as an investment.

The possible impact of economic processes on the supply of scientific knowledge has hardly been investigated. Among existing analyses, one can discern two apparently contradictory positions:

(1) It is asserted that scientific progress occurs in splendid isolation from economic demand and interests. The utilization of scientific knowledge for productive purpose is driven by the supply of knowledge which happens to be at hand. Utilization follows opportunistic principles; and

(2) The growth in the supply of scientific knowledge is induced by the demand for such knowledge, especially economic needs determine the path of scientific development.

In his study Invention and Economic Growth, which is concerned with an account of inventions and their dissemination from an economic point of view, Jacob Schmookler (1966:184), for example, argues that economic demand "induces the inventions that satisfy it". The supply of inventions, one concludes, is totally elastic and independent of time and place. Each need generates the invention it requires.

One of the basic difficulties with this thesis, of course, is that you cannot explain the perplexing persistence of many unfulfilled individual and collective needs. Why has it been impossible to satisfy these needs with appropriate scientific discoveries? Schmookler tries to escape this difficulty by concentrating on existing or successful inventions, more concretely, patents which have been issued. But this approach does not assure a clear separation and independence of the demand factors which are supposed to generate appropriate inventions. [19] Available knowledge is structured in a certain manner and not evenly distributed in relation to different external needs and requirements.

Undoubtedly, economic motives have played a major role in shaping the direction of the development of scientific knowledge but only within the changing limits and constraints of a body of scientific knowledge that is enlarged at uneven rates among its sub-disciplines.

A much more novel hypothesis about the reasons for the growing need for knowledge in modern society is presented by Peter Drucker who suggests that the impetus for the increasing demand has to do less with more difficult and complex job skills but more with the considerable extension in the working life span of individuals. Thus, it is not so much the demand for labor and particular skills, but the supply of highly skilled labor that underlies the transformation of society into a knowledge society. Drucker's (1969:278) thesis therefore is that the nature of work changed with the arrival of the highly educated workers. Because knowledge work is demanded, knowledge jobs have to be created. Thus, Drucker proposes a "supply side explanation" of the transformation of industrial society into a knowledge society. The extension of education is itself a reflection of a drastic lengthening in the work life expectancy.

Although the debate about the relative importance of different factors accounting for the growth and the demand for knowledge is inconclusive, the conditions for the possibility of added-economic value are shifting more and more toward knowledge as a constitutive force of production. New realities require therefore novel efforts to measure the nature and extent the contribution of knowledge.

Summary and Conclusion: Knowledge and Information

Finally, I would like to take up the question of the relation between knowledge and information. Is it still possible and sensible to distinguish between information and knowledge? In light of the fact that these notions are often used as virtual equivalents, this appears to be a conceptual distinction most difficult if not impossible to sustain.

Nonetheless, a discussion of the interrelation of knowledge and information provides me with an opportunity to summarily rehearse some of the comments I have made about the role of knowledge in social affairs.

Knowledge constitutes a capacity for action. Knowledge enables an actor, in conjunction with a control over the contingent circumstances of action, to set something in motion. Knowledge always requires some kind of attendant interpretive skills and a command of the situational circumstances. If sold, knowledge enters the domain of others, yet remains within the domain of the producer. Knowledge constitutes a basis for comparative advantages. The power knowledge offers is mainly linked to a control over additions to knowledge not the general stock of knowledge. In this century, knowledge becomes an immediately productive force.

The function of information is, as see it, both more restricted and more general. It is more general because information is by no means as scarce as is knowledge. Knowledge use is more restricted and more limited in its use-value because knowledge by-itself does not allow an actor to set something into motion. [20] Information is self-sufficient and lacks the enabling qualities of knowledge.

I hope that some of these reflections about the nature and the social role of knowledge in contemporary society are immediately productive reflections for the purpose of the workshop.

Appendix

Expenditures for knowledge production

Despite the almost heroic efforts of Fritz Machlup and his students to quantify the expenditures in the United States on knowledge production (and distribution), I will present their most important findings, have had attempts to legitimize the theoretical and empirical analysis of the economic value and the role of knowledge, at least among professional economist met with little if any resonance (cf. Machlup, 1979). The difficulties connected to such an enterprise undoubtedly are immense unless one is prepared to concede from the beginning such an undertaking is futile to begin

Table 1: Public Expenditures on Education (in US Dollars), 1975-1988

Areas	Public Expenditures on Education as a % of GNP				per Inhabitant			
	1975	1980	1985	1988	1975	1980	1985	1988
Africa	4.6	5.2	5.8	6.6	19	41	37	39
Asia	4.3	4.5	4.3	4.4	20	41	43	71
Europe [a]	5.7	5.5	5.5	5.4	197	336	285	435
Oceania	6.5	6.0	5.8	5.6	334	464	436	635
North America [b]	7.4	6.7	6.7	6.8	550	802	1108	1349
Latin America	3.6	3.9	4.0	4.0	42	91	71	90

[a] Includes the U.S.S.R.

[b] Data for the United States refer to total public and private expenditures on education.

Source: UNESCO, Statistical Yearbook, 1990.

with. The process of quantification and therefore the extension of conventional economic bookkeeping to knowledge is fraught with methodological problems because one of course has to rely on information, or guesses that otherwise proceed from the assumption that knowledge is not a common factor of production. But aside from the immense difficulties of generating empirical information about different categories of knowledge or, even separate between the production of information and knowledge, in the final analysis, one will be forced to treat knowledge as a kind of black box in the process of measuring the economic value of knowledge.

The expenditures of a country on education (see **Table 1**) or the public and private appropriations and investment in research and development are only capable of providing an indirect measure of the societal costs of knowledge production. Nonetheless, internationally comparative data are informative because they can offer a rough picture of the different efforts and of concentrations of educational and research efforts of different nations and regions of the world.

From a theoretical point of view, attempts to quantify knowledge is difficult to justify because knowledge is less as well as more than a conventional commodity and its value. In a strictly economic account, the value of a commodity can only be determined on the basis of the price it generates in market context. But knowledge rarely acquires such an exchange value.

The most recent data generated as part of the research programme to quantify the overall expenditures for knowledge production in the United States may be found in Rubin and Huber's (1986) study. Their attempt to measure knowledge incomes and expenditures connected with commodities and services constitutes the deliberate effort to extend Fritz Machlup's 1962 investigation into the proportion of the Domestic Economic Product that goes to knowledge production.

Table 2: Expenditures for Knowledge Production U.S.A., 1958-1980 as a percent of adjusted GNP

	1958	1963	1967	1972	1977	1980
Education	11.8	13.3	14.7	14.8	13.7	12.5
R & D	2.2	2.6	2.6	2.2	2.1	2.2
Media	7.7	7.5	7.7	7.9	8.1	8.0
Information machines	2.0	2.4	2.6	2.3	2.7	3.2
Information service	4.9	5.2	5.7	6.7	7.6	8.4
Total	28.6	31.0	33.3	33.9	34.2	34.3
Adjusted GNP (in billion $)	485	648	872	1,275	2,052	2,823

Source: Rubin and Huber (1986:19)

Rubin and Huber (1986:3) sum up their findings by indicating that the proportion of knowledge production as a percent of the (adjusted) Gross National Product (GNP) in the U.S. increased from 29 percent in 1958 to 34 percent in 1980. Such a rate of growth is, of course,

when judged against some extravagant expectations and when compared to the average increase in the rate of growth of other elements of the GNP, "an extremely modest rate of growth". How controversial these figures can be and how closely related their interpretation is to the prevailing theoretical perspective of the author becomes evident by comparing the estimates of Machlup and Braverman (1974). In attempting to estimate the proportion of expenditures for knowledge in modern economies and the role of knowledge in the production process Machlup (as well as Bell and Drucker) arrives at numbers which differ considerably from Braverman's results. Braverman bases his estimate of the proportion of "knowledge work" (in distinction to the cost of knowledge production referred to earlier), as does Machlup (1962), on the occupational classifications of the U.S. Census. Braverman (1974:241-242) arrives at the conclusion that there is a remarkable concentration of technical expertise in the United States in a relatively small grouping of occupations. On balance, therefore, "it is probably proper to say that the technical knowledge required to operate the various industries of the United States is concentrated in a grouping in the neighborhood of only 3 percent of the entire working population - although this percentage is higher in some industries and lower in others." Machlup's (1962) estimates for the same time period and the same economy differ, however. He puts the proportion of "knowledge workers" at about 40 percent of the working population while Drucker (1969) estimates the proportion of "knowledge work" to reach up to 50 percent of the Gross National Product in the U.S. It is evident that Braverman employs an extremely narrow definition of what constitutes the mobilization of technical knowledge and expertise in industry and in the service sector, that is, he confines his estimate to those occupations labeled "technical engineers" and "technicians" (that is, occupations responsible for the design of the production process) by the U.S. Census Bureau because he wants to stress the persistence or emergence of new forms of degrading work and exploitation, for example, the separation of the conceptualization from the execution of work, under monopoly capitalism. The engineering profession as a result is viewed by Braverman (1974:243) as subject to the well-known constraints of other forms of mass employment, namely "rationalization and division of labor, simplification of duties, application of mechanization, a downward drift in relative pay, some unemployment, and some unionization." Where Braverman emphasizes the growing homogenization of the workforce, Bell and others observe an expanding scope for occupational differentiation in the modern economy. Where Braverman notes an increase in the intensity of the subordination of labor to capital, Drucker and others conclude that the sphere of autonomy and self-determination of employees is enlarged. In both instances, however, rather little attention is paid to the actual processes of work, the organization of work and of whatever control may possibly be exercised. [21] Knowledge and expertise are treated as black boxes.

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[1] In retrospect, one is able to describe a variety of ancient societies as knowledge societies, for example, ancient Israel, which was a society structured by its religious-lawlike Tora-knowledge. Ancient Egypt was a society in which religious, astronomical and agrarian knowledge served as the organizing principle and the basis of authority.

[2] In this paper, I draw on ideas first advanced in Nico Stehr, **Knowledge Societies**. London: Sage, 1994.

The sociological conception of knowledge advanced here resonates with Ludwig von Mises' (1922:14) definition of property, for von Mises suggests that as a sociological category, "property represents the capacity to determine the use of economic goods." Based on the idea that knowledge constitutes a capacity for action, one can of course develop distinctive categories or forms of knowledge depending on the enabling function knowledge may be seen to fulfill. I believe Lyotard's ([1979] 1984:6) attempt to differentiate, in analogy to the distinction between expenditures for consumption and investment, "payment knowledge" and "investment knowledge" constitutes an example of such a functional differentiation of more or less distinctive forms of knowledge.

[3] More specifically, Bacon asserts at the outset of his Novum Organum that "human knowledge and human power meet in one; for where the cause is not known the effect cannot be produced. Nature to be commanded must be obeyed; and that which in contemplation is the cause is in operation the rule."

[4] Perhaps I should point to a competing definition of "knowledge" which sets knowledge identical with action or conceives of knowledge as emerging from action. Peter Drucker (1969:269) observes that knowledge as "normally conceived by the 'intellectual' is something very different from 'knowledge' in the context of 'knowledge economy' or 'knowledge work'... Knowledge, like electricity or money, is a form of energy that exists only when doing work. The emergence of the knowledge economy is not, in other words, part of 'intellectual history' as it is normally conceived. It is part of the 'history of technology,' which recounts how man puts tools to work." In a recent study, Drucker (1989:251) very much affirms this conception and defines knowledge as information that "changes something or somebody - either by becoming grounds for action, or by making an individual (or an institution) capable of different and more effective action. And this, little of the new 'knowledge' accomplishes."

[5] The thesis that knowledge invariably is pushed to its limit, that is, is realized and implemented almost without regard for its consequences (as argued, for instance, by C.P. Snow [cf. Sibley, 1973]), constitutes of course a view which is quite common among observers, for example, of the nature of technological development. However, the notion that science and technology inherently and inevitably force their own realization in practice fails to give, for one thing, proper recognition to the context of implementation by assuming such automaticity in the realization of technical and scientific knowledge.

[6] The definition leaves room, therefore, for a "dialectical" theory of the use of knowledge.

[7] Enabling actors to translate and employ them for the identical purposes and for closely similar outcomes.

[8] Compare Lazega's (1992) essay on the "information elaboration" in work groups and the relations between information and decision-making in and dependent on "local" contexts.

[9] If knowledge indeed would "travel" almost without impediments and could be reproduced largely at will, the idea that the creators of what typically constitutes "new" knowledge in modern

society, namely scientists and engineers, would have to be located at the Apex of power in such societies certainly would make considerable sense.

[10] Peter Drucker (1993:184) observes, however, that initial economic advantages gained by the application of (new) knowledge becomes permanent and irreversible. What this implies according to Drucker is that imperfect competition becomes an constitutive element of the economy. It is of course the case that knowledge once widely disseminated and applied, that is, beyond the boundaries of the organization that initially gained an edge as the result of being ahead of its competitors does not literally loose the now more widely "shared" knowledge since this is one of the peculiar properties of knowledge. Knowledge can be disseminated or sold without leaving the context from which is disseminated or sold. The edge that remains is perhaps best described as an advantage --that could be minor bit may also be quite significant -- based on cumulative learning.

[11] In the early sixties, during the de-Stalinization period, orthodox Marxist philosophers, for example, in East Germany, discussed the notion of science as an "immediately productive force", last but not least as a corrective to the "undialectical" conception of science advanced by Stalin (cf. Klotz and Rum, 1963:27). But aside from the work the notion of science as an immediately productive force had to accomplish in the ideological struggle underway, the concept mainly referred, as far as I can tell, to the idea that production becomes the material realization of scientific discoveries (e.g. Stoljarow, 1963:835; actually, it is claimed that Walter Ulbricht initially employs the term, cf. Klotz and Rum , 1963:26). Later, somewhat more elaborate conceptions of the notion of science as an immediately productive force also are in evidence. For example, labor is described as a form of scientific work (e.g Lassow, 1967:377); yet, such discussions continue to be embedded in the struggle against "narrow" Stalinist conceptions of the forces of production.

[12] However, some observers would assert that we are witnessing, as the result of technological transformations, especially in conjunction with the proliferation of information-processing machines, a radical "exteriorization" of knowledge with respect to the "knower". With it, the relationship of the "suppliers and users of knowledge to the knowledge they supply and use ... will increasingly tend to assume the form already taken by the relationship of commodity producers and consumers to the commodities they produce and consume - that is, the form of value. Knowledge is and will be produced in order to be sold, it is and will be consumed in order to be valorized in a new production: in both cases the goal is exchange" (Lyotard, [1979] 1984:4). What counts according to Lyotard, therefore, is the exchange and not so much the use-value of knowledge.

[13] It would seem that economists tend to prefer a conception of the value of knowledge which closely resembles their conception of value in the case of any other commodity, namely, value derives from the utility of the "product" knowledge (use-value) although there remains a considerable range of interdeminacy when it comes to the expected value of knowledge (e.g. Bates, 1988).

[14] In an effort to arrive at ways of determining the value of information as an economic good, Bates (1988:80), for example, argues that there is an inherent imbalance in the fixed cost and variable cost component of producing (and re-producing) information. The production of information has an exceptionally high component of fixed and a very low, even nonexistent variable cost component (the costs associated with the replication of the information) because information is infinitely reproducible and consumes all other resources. Such a treatment of

"information", of course, is only plausible as long as one is convinced that reproduction is virtually unproblematic (e.g. transcends the initial conditions of production including the costs associated with it) and can be repeated at will because production is definitive and does not require any intermediaries or subsequent interpretation.

[15] However, the forms of knowledge that may be utilized to achieve such advantages are not confined to scientific-technical knowledge. Such a conclusion already follows from the theorem that knowledge is a kind of anthropological constant. But it also follows from conceiving of knowledge as a capacity for action because knowledge then becomes, as Lyotard ([1979] 1984:18) stresses, "a question of competence that goes beyond the simple determination and application of truth, extending to the determination and application of criteria of efficiency (technical qualification), of justice and/or happiness (ethical wisdom), of beauty of a sound or color (auditory and visual sensibility), etc."

[16] For a significant part, the service sector of society lives off selling knowledge. The educational system employs millions who make a living by disseminating socially necessary knowledge. The control of the free circulation of knowledge cannot only be hampered by limited access to the pre-conditions for its acquisition but also, in a legal way, by assigning property right to it. One only has to refer to patent and copyright laws. In many countries, patent and copyright laws are no longer confined to technical artifacts and processes but include intellectual ownership in art, music, literature, and increasingly, scientific inventions.

[17] Daniel Bell ([1979] 1991:237-238) also observes that knowledge in form of a "codified theory is a collective good. No single person, no single set of work groups, no corporation can monopolize or patent theoretical knowledge, or draw unique product advantage from it. It is a common property of the intellectual world." Bell's characterization of the main reasons why (codified) knowledge constitutes a collective rather than a private good allows the inference that such qualities derive, on the one hand, from their peculiar epistemological attributes and, on the other hand, from the effective operation of the ethos of the scientific community, especially its negative sanctions against secrecy. In contrast to Bell's views, I attempt to stress that it is the social nature of knowledge itself, its production and reproduction, which eliminates the possibility that it becomes the exclusive property of individual or of corporate actors.

[18] Charles Derber and his colleagues arrive at a somewhat different conclusion in their analysis of the societal authority and influence of professional occupations in the United States. On the basis of the assumption of the enormous historical variability of what passes for and is accepted as knowledge and therefore the suspicion that almost anything may be sold as "knowledge" as long as this group is successful in persuading clients that they in fact have use and a need for the knowledge controlled by a certain occupation and that this knowledge is superior to everyday knowledge, "professional" knowledge takes on the typical attributes of the construct of "property". Knowledge becomes a commodity because the peculiar nature of the demand (as well as the needs it serves) and the strategies to meet the demand are fully controlled by those who offer the knowledge in question.

Among the crucial strategies is the privatization of knowledge. The prohibition barring lay practice is one of the most powerful strategies to "privatize" knowledge. In a kind of self-created enclosure and self-policed circle knowledge becomes a commodity (cf. Derber, Schwartz and Magrass, 1990:16-18). Even if one assumes that it is relatively easy in practice to legitimize and monopolize knowledge, Derber and his colleagues overestimate the passivity of the consumer and

the solidarity of the professional fraternities. A more significant drawback of their positions, it seems to me, is the fact that they once again discard any concrete analysis of the knowledge base of the professionals and rest their case with fairly formal attributes of the knowledge of professionals. The status of the attributes Derber and colleagues invoke appear to be applicable to any knowledge claim and the case boils down to a question of power enabling professionals to set and control cognitive agendas. It is not clear, for example, why scientific knowledge claims have displaced magic since both are functional equivalents as a source of control for the powerful. However, knowledge is not always identical.

[19] By concentrating on "successful" inventions, in the form of patents granted, one is unable to identify and define the role of demand forces independent of the evidence that the demand was satisfied (cf. Rosenberg 974:97).

[20] A good example of information is price advertising and other market information such as availability of a product. Such information certainly can be useful; in the context of the modern economy it is widely available, but the consequences of having such information as such are minimal. From the point of view of a consumer, price information combined with knowledge about the workings of the market place may, on the other hand, constitute a capacity to effect some savings.

[21] Newman and Newman (1985:499) stress that with respect to the impact of information technology "little attention has been paid either to ascertaining how central internal control problems actually are in determining the use of Information Technology by firms, or to the question whether particular instances of fragmentation or de-skilling do in fact result from management strategy, or from other causes such as the limited capabilities of current technology, or the selling strategy of equipment suppliers which may in fact be designed to present these defects of their products as if they were virtues."