This is a translation of the article: Balzer, W. 2003. Wissen und Wissenschaft als Waren. *Erkenntnis* 58, 87 - 110.

Knowledge and Science as Commodites

Wolfgang Balzer

University of Munich LMU, MCMP

Introduction

In the last few decades, there has been an apparently accelerating change in science: ever-larger parts of science are being relocated to the field of the private sector. In addition, efforts are being made in some European countries to organize academic research according to economic principles. It seems like a slow commercialization of science is taking place. A large part of the development seems to have already taken place. In the revolutionizing (and perhaps wiping out) disciplines of genetics and biochemistry today, the relevant activities predominantly take place in private laboratories, this also applies to wide areas of computer and natural sciences.

The reorganization of state research institutions in the field of education, especially those of universities, has triggered a first clearly articulated disapproval among those affected. Researchers at these institutions have so far been able to understand and present themselves as models for science, for a science whose goal and social justification was to carry out not directly applicable (basic) research in addition to the training in directly useful skills and, above all, to maintain a certain level of education for the benefit of the general public, the 'standard level'.

A particularly sensitive question for universities is whether the restructuring of the universities according to economic criteria, as it is currently done, can fully satisfy the nature of science or whether certain peculiarities of science are overlooked. For politics and economy, the first question seems to be answered with a clear 'yes'. The motivations are easy to understand. It is only natural for *business captains* to organize a production area - knowledge, education, and training - according to the model of their companies. For economists, the application of their theories also to scientific systems represents a considerable expansion of application and thus a considerable scientific success. Politicians follow their advisers in these things: the economic captains and economists.

To date, science has not been adequately represented in these political plans, to put it mildly. Many commissions are equipped with many scientists, but very few

of them are representatives of the disciplines for which the issues discussed here are scientific issues. Relevant would be here especially theory of science, science research, and philosophy. The lack of presence of these disciplines is certainly due to the fact that research into science in these areas is not yet very advanced. Theory of science is limited to the study of knowledge and sociology on scientific actions and institutions, but only a combination of these two dimensions can produce applicable models.

The present work examines, on the basis of the current state of discussion of the three disciplines mentioned, the question of whether the economization of science, on the basis of relatively clear criteria, is suitable for increasing the efficiency of science, and it comes to a negative result. Our discussion is deliberately descriptive. On the one hand, this should serve as a better elaboration of evaluations, which are implicitly assumed in the usual, daily politically colored contributions. On the other hand, it is intended to encounter the efficiency arguments which to-day are repeated mechanically by all organizers of science, in a descriptive-rational way.

The restriction to the descriptive level must not be regarded as a lack of courage of applying normative arguments. On the contrary: at the normative level, the situation is so clear, at least for experts with a broader view that it does not seem necessary to conduct a discussion of this kind at a professional level.

1 Commodities in economics

The concept of commodity comes from the environment of economic activity and is used in different meanings. We do not want to use it here in the groundless, vague depth of Marx, for example, or in the axiomatically precise, but in the interpretation completely uninhibited way of modern equilibrium[1] theory, but in a moderate sense oriented towards today's living environment. As a result, a commodity has four properties.

First of all, it is an object of exchange, which means more precisely: it is used in an exchange. In the case of one exchange, person A hands over a commodity to person B and receives from B in return another commodity. In an idealized way, in an act of exchange the exchange partners should be equal, insofar as they both hand over their commodities without direct external coercion. The counterpart to an exchange is the exertion of power in which the more powerful person causes the other by threat, to hand over a commodity to her. There is not a sharp border between these two ideal-typical forms, but one can theoretically argue that exchange is a borderline case of the exertion of power. The crossing of this border takes place if a threat gets weaker and is replaced by incentives.[2] In the borderline case the advantage of the more powerful person shrinks until both persons have about the same degree of power over each

[1] The standard reference is (Debreu, 1972).
[2] See (Balzer, 1994).

other.[3]

In addition to the concrete occurrences of commodities in acts of exchange, also commodity types are important, i.e. sets of possible occurrences that are similar in certain respects. In the end, the act of exchange is always about concrete occurrences, such as two apples or two companies. However, the act of exchange is conceptually combined with preliminary considerations and decisions on the nature and quantity of commodities to be exchanged, and on the commodity types used. Whether it is spoken about commodity types or occurrences depends on the context.

Secondly, every commodity is produced or elaborated. Although there are exchange objects that do not meet this condition at first glance (a beautiful body, a random, 'ingenious', scientific or artistic idea). However, from a social point of view, such objects are less important and should therefore systematically not be taken into account here. If the concept of production is defined broadly enough, almost all exchange objects are elaborated. A beautiful body requires care, the ingenious idea requires prior training; also the collection of wild berries makes trouble.

Thirdly, rights of disposal belong to every commodity. Everything that can be exchanged can also be disposed of. By the right of disposal over an object we want to understand a legal right or a right which is at least fixed by customary norms. A person can do what she wants to do with the object, but within some fixed limits. Material commodities satisfy this condition in a clear way, but it also applies to actions and ideas. The actions of a slave are available to his owner, even today's employer has, within narrower limits, rights of disposal over the actions of the employee. Even today, rights of disposal over individual actions are exertiond by vast extent. For example, it is not always the case that after the termination of the employment contract, the employee is again free to take all the actions that he had before entering into it. One thinks of insider regulations in the stock exchange sector, secrecy regulations in armaments, or requirements in the patent system. After all, ideas and knowledge content are increasingly becoming the property of the patentee through patenting. Recently, for example, a process has been patented in Europe that theoretically makes it possible to grow embryos and human organs[4] from stem cells and in the USA someone managed to grant a patent on the well-known rules of Kirchhoff.[5]

A special case of right of disposal is property. Also the owner has the right to do what he wants with objects in his property within limits. Rights of disposal are more general than property rights. The limits of property rights of an owner are delimited by the society, while a right of disposal, for example through a contract, can be concluded 'locally'. In particular, property always creates rights of disposal.

With property and often also with the right of disposal of commodities goes hand in hand - although not necessarily, but practically almost without exception - the heritability of property and rights. In almost all social systems that know the concept

[3] See (Balzer, 1998b, 2001) for corresponding analyses of equality in relation to power.

[4] Patent Nr. EP0695351 at the European Patent Office Munich.

[5] See (Shulman, 1999).

of property, property can be inherited. In the case of material commodities, inheritance works smoothly, for ideas that have become commodities, inheritance is currently still the exception. For example, publishing rights or patents can pass from the testator to the heir. In the case of commodities that are given as actions, inheritance is more difficult. Although a slave, for example, can pass into the property of the heir together with his possible actions, this has no lasting consequences, because the slave eventually dies even and possibly without descendants. Somewhat clearer is the possibility of inheriting action types. Thus, in feudal Europe, the wearing of certain garments was reserved for the ladies of the high nobility and the corresponding type of action was thus hereditary in a certain sense. Currently, action types in the form of certain technical processes are inheritable under patent law, but the expiry of patents sets certain limits.

Fourth, commodities are objects to which utilities are attributed. A person derives utility from the consumption or property of a commodity. This condition is the other side of the above, second condition. Commodities have utilities because they have been produced and vice versa. Since utility is currently the central basic concept in the most comprehensive and subtle theories in economics and social science[6] on which the self-image of today's most important societies is based, the fourth condition anchors the concept of commodity at the center of today's understanding of society. However, this fourth condition does not yet involve a commitment to a specific, contemporary, economic theory.

2 Commodities in science

'Science' should be understood here in such a way that in addition to the content, the knowledge, also the actions of the scientists, as well as scientific institutions are counted as parts of science. Persons are called scientists, if they are trained to carry out typical 'scientific actions'. Scientific action types can be positively listed for practical purposes, but an overview is not required[7] here. In science, as just discussed, commodities of all the species described above are to be found.

The most important here are ideas or clearly definable knowledge. This can usually be represented linguistically, the corresponding commodities are then given by sentences (or language invariant by: propositions). Both data and hypotheses, as well as descriptions of processes, can become commodities. An example from the domain of data are the data on the consequences of amino acids in the human genome, which were now patented piecemeal, each by the group that performed the decoding. The example of rules of Kirchhoff for the patenting of hypotheses has already been mentioned in section 1 and technical processes have been patented since the patent system

[6] (Debreu, 1972) for economy, (Austen-Smith & Banks, 1999) for political science and (Osborne & Rubinstein, 1994) for game theory.

[7] See e.g. (Balzer, 1997), Chapter 1.

existed. Knowledge protected by patents has all four characteristics of a commodity. It can be exchanged (for example, sold for money), it is worked out, is a property (and thus available), is heritable within limits, and is an object of considerations of utility.

However, patenting is only one way in which knowledge is turned into a commodity. Far easier and more frequently, this is done through contracts. For example, a female scientist is recruited by a private research laboratory with a high salary because she has special knowledge. Her knowledge becomes a commodity through the employment contract; she passes it on to the laboratory and its owner and receives her salary in exchange. Knowledge is an object of exchange, has been developed, is a property (after the conclusion of the contract: of the laboratory), and has an utility. Another example: a researcher in the arms industry has contractually committed himself to the secrecy of his results. He makes an important discovery in his work. Exchange is also possible here. He could exchange the discovery for a better position with the opponent in breach of his commitment. The knowledge has been developed, is the property (of the armaments company), and has a utility.

Knowledge is usually represented by sentences. But there is also implicit or expert knowledge that is in the brains of people or iis n an larger environment somehow present, but is not formulated linguistically. The corresponding commodities, the 'expert knowledge', in this case, consists of the actions of the expert and his judgments.

Scientific actions become commodities above all in contractually regulated relationships in which rights of disposal over the actions are defined. This almost always applies to the actions of a scientist working in industry. His superior has - within limits - the right to use the actions of the scientist as the superior wants. This means that the four conditions of commodities are met. The actions are objects of exchange, they are produced (to act is work) and are the subject of rights of disposal and utility assessments.

If in a contractually regulated relationship, no instruction is given to the scientist to carry out this or that concrete scientific action, there are also no rights of disposal. In these cases the actions of the scientist have not, at least ideally speaking, the character of a commodity. Although her actions are an object of exchange (for salary), and they have utilities, they cannot be used by any other person for their purposes. Such contracts of research are often applied to civil servants.

There are also specific material commodities in science. We are thinking, for example, of strains of viruses or microbes, enzymes, technical apparatuses that exist only in a few copies, or simply books and journals. They meet all four conditions of commodities.

As for the extent to which science deals with commodities, it is currently true that there is a wide range of objects, especially ideas and knowledge expressed in sentences and of scientific actions that are *not* treated as commodities.

We did not formulate the concept of commodity in a dispositional manner. Something is a commodity only if it actually occurs in an exchange and if it is subject to

rights of disposal. The act of exchange must be defined so broadly that supply and demand already count as the first steps in the action. According to this definition, an object can have the status of a commodity at one time, lose it at another time. For example, a factory whose owner does not think about selling the factory itself is not a commodity; it becomes so when the factory is put up for sale. Likewise, the apple that hangs on my tree is not a commodity as long as I intend to consume it myself.[8]

The set of scientific results and scientific actions can be divided into those items which are technically, biologically, or medically usable and to a 'rest'. The first class now also includes results of basic research, including formal sciences. The second class comprises the results of the humanities, while the knowledge from social science is to be divided into both categories. This depends on whether results or actions can be used for socio-political and general political decisions with a broad understanding of 'technically usable' in the sense of 'social technology' or can not be used.

New ideas and sentences from the first area are today produced to a large extent - perhaps already for the most part - in the private sector and in the armaments sector. These items are patented or are not published at all. Therefore they have the status of commodities. The same applies to the scientific actions carried out in these areas. If these take place within the framework of contracts aimed at researching certain contents, the actions meet all the conditions for commodities.

Even if we cannot specify the exact scope of this domain of commdities in science, these indications should have made two points clear. On the one hand, there is a large area in science in which thinking and acting takes place in commodity categories. On the other hand, there is also a large area in which this is not the case. Presumably, the range of commodities has expanded considerably over the last 300 years, but without historical research, this remains a speculative hypothesis. On the other hand, it can be said that at the moment a kind of patenting fever is rampant, especially in the USA, due to references to all sorts of strange patents, as well as the introduction of patenting offices at major US universities. The current trend in politics towards privatization and economization gives rise to the assumption that the expansion of the range of commodities in science will continue.

3 Reasons for success of commodity-oriented trading

The handling of interpersonal matters through commodities has proven to be particularly successful compared to other forms of interaction. Commodity-oriented action spread steadily, pushing back other patterns of interaction. Such spread can be seen as a criterion for success. When applied to science, success in this sense would mean that commodity-oriented action in science would spread by pushing back alternative

[8] The alternative, dispositional way of use, according to which something is already a commodity if it meets the four conditions under possible circumstances, leads to a boundless term which can be applied practically to everything. In this way the term has no interest.

forms of interaction. Although such a tendency to spread is clearly perceptible at the moment, it would be premature to consider the matter as agreed. In order to be able to speak of success, which is also based on substantive reasons, there must be a long, 'successful' development over historical periods. The current development could only be a social phenomenon of the category of fads that spread in the short term without recognizable rational reasons and are then replaced by other fads. An indication of this could be the motivational background mentioned in the introduction.

For the following discussion, we need to distinguish between two levels of comparison. On the one hand, economic and scientific activities are combined with scientific action. This ultimately boils down to the comparison of comprehensive, competing forms of life and society, which leads deep into philosophy and is not intended here. On a second level, to which we limit ourselves here, the comparison of forms of action is limited to one of the two areas. We ask whether one form of action is more successful than another in the economic field, and the same question is asked for the scientific field. These more limited questions are open to further analysis because we can formulate relatively simple success criteria for each of the two areas mentioned, which do not amount to competition between business and science. For the economy, we can characterize degrees of success by the fact that the economic system, the economy, runs or functions better or worse, and this, in turn, means that more or fewer commodities are produced. In the same way, degrees of success within science are distinguished by the fact that more or less scientific results, in the general sense of sentences, ideas, processes, and types of actions, are produced. Of course, these levels of success also become problematic on closer inspection. For example, how should the quantity and quality of commodities be offset against each other? However, it turns out that even these rough concepts of success have a differentiating effect on our topic.

We are now going through a number of *reasons for success* for commodity-oriented action in business and check in each case whether they also apply to science.

The first reason for success is that in the act of exchange the participants are equal to each other. They do not act on command or by order, but on their own initiative, and thus to promote their own utility. For the individual, there is thus the incentive to produce commodities used in exchange as long as the advantage obtained when exchanging with them is greater than the cost of production. In exchange, there is also no need to rely on the normative justification and consolidation of socially different positions and on the monitoring of giving orders. Commodity-oriented management is, therefore, more efficient and leads to more production (and thus to greater success) than other types of interaction based on power. Formally, this is expressed in the fact that exchange in a sufficiently static environment leads to Nash equilibriums,[9] i.e. to strategy combinations in which no participant has an incentive to deviate from his strategy.

However, two limitations of this efficiency advantage should not be forgotten. Equality of individuals as exchange partners in an exchange situation does not mean

[9] See, for example (Osborne & Rubinstein, 1994), 2.2.

that exchange at the group level leads to a balance of individual possessions. As the formal models of economics show, the exchange economy is completely neutral towards differences in distribution, and empirically there seems to be much to suggest that in the present historical manifestations they lead to increased unequal distribution of commodities. Also, the equality of the exchange partners often applies only approximatively. In many cases, differences in power between those involved in the exchange lead to more power of the 'partner' gaining an advantage.

Can this reason for success be transferred to science? Exchange of knowledge or scientific actions usually takes place by getting money. In science, there is no paradigmatic basic area in which the exchanged objects are of the same kind as in the economy for material objects. The 'exchange partners' are at different levels right from the start. It is true here that the exchange of scientific commodities leads to a more efficient pursuit of self-interest and thus provides a greater incentive to develop these commodities than power-based alternatives. But in addition to the exchange of commodities as a model for the production and distribution of scientific products, another system has developed in science, namely, the peer review procedure, in which the value of scientific work is primarily determined by the recognition of fellow scientists and the individual utility necessary for the exchange of commodities only results secondarily from the value as a derived quantity.

Historically, the peer review procedure has developed among gentlemen for whom science was not a livelihood. At universities today we find it in mixed form. On the one hand, this procedure is relevant for finding jobs for scientists and thus also for getting incomes, as long as political influences do not prevail in the specific case. On the other hand, the basic income is secured for people with lifetime employment, so that only part of the individual utility is determined by the procedure of valuation.

In the peer review procedure, scientific results do not have the status of commodities. There are neither deceptions between two persons nor rights of disposal. The scientist 'exchanges' his results for recognition, which is expressed anonymously by the entire scientific community and no one gets special rights of disposal over the results through the procedure, unless we call the unlimited publicity of the results a right of disposal (namely as a right of disposal for all people). It is also important that the peer review procedure does not require the financial independence of the scientists. In principle, it can be used in an ideal-typical form to determine the full, individual utility, including full income.

In view of the existing alternative of exchange of commodities and peer review procedures, the *efficiency question* arises for the assessment and evaluation of commodity-oriented action in science: Is the purely economic exchange of commodities more efficient in science than the peer review procedure? If science is to be subjected to economic thinking, then this question should be answerable positively.

A second reason for the success of commodity exchange in economics is based on the fact that it is the appropriate means of controlling labor. The exchange of working time or a spectrum of labor actions for wages contains a greater incentive for

the employee to perform than the historically earlier forms of using slaves or drudgery. Labor control via exchange has such an efficiency advantage over the earlier types that it has been able to eliminate them in a large extent.

When applying it to science, we have to distinguish between two cases. In the first case, the scientist (in the role of the person to be controlled) has some freedom with regard to the research goals. In this case, the control is reduced to the selection of research directions, within which there can usually hardly be any talk of directing the work. The employee is found in a situation where self-interest is more at stake than control because payment is related to performance, i.e. related to scientific results. In this case, the reason for success for commodity-oriented action also remains valid for science, but it has little power because there is hardly any control.

In the more interesting second case, the research goals are specified and by controlling the work via exchange for remuneration, an attempt is made to achieve these goals as efficiently as possible. In this case, the reason for success for commodity-oriented action is only superficially preserved. Relative to the given goals, incentives for performance through remuneration (exchange of commodities) are effective. However, it is questionable whether such a system can lead to an overall higher scientific output. A second question therefore is the *steering question*: Can science achieve better results if the selection of the research objectives and the organization of scientific work (for specified objectives) are carried out in a commodity-oriented manner?

The third reason for success for interaction via commodities in the economy is the material nature of the core area of exchange objects. *Material objects* are in a sense better suited for exchange than immaterial objects. Although non-material objects can also function as commodities, the central core area of commodities has existed up to now and still consists of material objects. For such objects, the first and the third condition for commodities are particularly easy to objectify. Compared to ideas and actions, material commodities can be exchanged more easily and made subject to dispositions. In the exchange of material commodities, differences of opinion can easily be compensated by involving third parties. The quantity and quality of material objects of exchange are in principle accessible to public perception and discussion; material objects are objective. The transfer of material objects can also usually be easily tracked and controlled. In the case of the right of disposal, the situation is similar. Whether an object is available to a person can be easily determined for a wide range of material objects. In conflicts, it is relatively easy to remove such an object from one person and make it available to another.

This advantage of material objects does not exist in science, because here the most important objects, ideas, and propositions (expressed by scientific sentences) are not material. Ideas and actions lead to efficiency problems when commodities are exchanged, which are dealt with the transaction cost approach.[10] These problems are also increasingly true in science. Scientific ideas are usually not born in a finished state, their elaboration and clarification according to scientifically recognized methods is an

[10] Compare, for example (Williamson, 1975).

essential part of scientific development. In order to become commodities (and patents), the ideas must be examined. One way is to increase the extent of examinations by patent law or otherwise specified and standardized methods in a way that goes beyond the existing purely scientific measures.

A pressure of objectification is forced by the character of the commodities will certainly bring a lot of profit for patent attorneys. However, it leads to the following objection, formulated as a third question, a *question of standardization*: Is it conducive to science if the process of normalization (clarification and precision) of new ideas and methods by non-scientific, e.g. legal, forces are being restructured?

A fourth reason for the success of commodity management is that the constitutive rights of disposal for commodities give the owners power and influence over other persons. According to the most widely held view, the exertion of power consists in getting a person to take action which it initially did not intend to carry out.[11] It is helpful to make a distinction here according to whether the rights of disposal are used 'positively' to get other people to perform certain actions, or 'negatively' to prevent certain actions. In the economy, commodities serve above all for the positive exertion of power. Rights of disposal both over material objects (especially money) and over actions (work) are used to get other people to perform certain, desired actions.

Such rights of disposal attached to commodities have the advantage over other rights to be more calculable and manipulable. Other rights can come from the consent of groups of persons or even from mere physical strength. For many people, therefore, economic activity is the most attractive way to acquire, maintain and increase power.

In science, too, commodities (especially money) and rights of disposal (via employment contracts) are used to exertion power. The scientific world is maintained in part by such 'normal', economic commodities. However, commodities of a special scientific nature are not well suited to exertion positive power. As far as the type of commodity 'knowledge' is concerned, it is far more difficult to use it as an offer or a threat to exertion power than a normal, economic commodity, because in the case of knowledge, the target person must be trained to such an extent that the knowledge in question is accessible to him. It is even more difficult to use the commodity type 'scientific action' to exertion power. In addition, both types of commodities cannot be used flexibly.

Rights of disposal over scientific commodities are preferably used for the negative exertion of power. Other persons or companies are prohibited from using certain knowledge and procedures. Patent protection is based on the fact that it makes larger investments profitable that would not be effective without it. In addition to this positive incentive, however, the negative one must not be overlooked: the prevention of efficient, competitive production and an increasing bureaucratization of the patent system, which makes it increasingly difficult for capital-weak individuals to apply for patents at all.

A special feature of knowledge is that one can only prevent its application through

[11] Compare for example (Wartenberg, 1992) for a more recent overview.

rights of disposal to the extent that it is somehow reflected in material form. Once the knowledge is present in a person, it cannot be deleted; it is not even possible to determine with ethically harmless means whether the person has acquired the knowledge. Therefore, knowledge can spread beyond the limits of disposition rights as long as it does not become manifest.[12] However, as soon as the knowledge in the application leaves material traces, the right of disposal becomes effective and enforceable.

A final reason for the success of commodities in the economy is the heritability usually associated with the rights of disposal, e.g. of property. This makes it possible for people to pass on their power directly to the biological descendants and this seems to play a primary role in many individually important decisions. In science, this property is only weakly pronounced, especially in the case of scientific commodities, because patents and employment contracts are limited in time.

4 Questions and assumptions

We now turn in detail to the three questions formulated in the last section. Unfortunately, compelling answers require more precise and comprehensive models of scientific and social development than are currently available to us. We must therefore come to terms with the rather rough answers that the current state of knowledge allows.

The question of efficiency is about the comparison of the economic exchange of commodities with the peer review procedure. Which process is more efficient in the sense that it generates more scientific output (knowledge, methods, scientific actions). Since knowledge is networked, 'more' cannot be understood purely quantitatively. An additional 'quantum of knowledge' in the right place can weigh 'more' than many isolated new elements of knowledge.

Since there is no quantitative model for the peer review procedure, a comparison at the level of models is not possible. Rather, the best way to compare is to consider the current state approximately as the state of a system based on the peer review process. This is compared with the state of a counterfactual system, of which we assume that there are similar material and personnel resources and in which there exist no peer review procedures. In these systems, knowledge, methods, and scientific actions are exchanged exclusively together with all other commodities according to the model of economic equilibrium theory. The question then is whether more scientific output can be expected in the counterfactual system than in the currently realized system.

When exchanging scientific products, the exchange partners are guided by their utilities. They exchange quantities of different commodities in such a way that the new equipment of commodities after the exchange brings them more utility than those before the exchange. Prices are formed, so that the differences of these prices correspond to the exchanged quantities of the different types of commodities. Thus,

[12] Effects of this kind are currently known on the Internet.

in our counterfactual system, prices for various scientific products will be formed, whereby the grouping in commodity types can be carried out according to areas of knowledge, methods, or action types. For example, data from the human genome might be traded as one type of commodity, the skills, and experience of conducting a particular type of experiment in mice as another.

In the purely economic model every scientist offers his product for sale, whereby he bears all production costs (education, research) himself. The product is in demand by individuals who have a need for special knowledge ('how to fight the ants in my orchard', 'how to prevent that my son gets the long nose of his parents'), and above all from companies that use the scientific product to create other commodities.

Two points stand out immediately. First, it is practically impossible to realize the pure model on an individual basis. If a person had to finance all the investments he makes in the production of a scientific product himself (e.g. through loans), only a very small part of the individuals would enter the production of science. From the very beginning, science is much more dependent on collective action than the exchange economy. In business, organizations and companies are, in principle, i.e. in the first primitive systems,[13] are not really necessary. But in science, organization is necessary from the beginning. In this sense, science is a socially higher and in this sense more progressive phenomenon in human development than commodity production. It would be surprising if the laws and forms of behavior from the more primitive social system were already optimal for the higher one, science.

Secondly, there are a whole lot of scientific products in the existing system for which the demand in the counterfactual system would be practically zero. In such a system, which would be based on science, these products would not be in demand and therefore not offered, i.e. not manufactured. We do not have to dwell on fields of knowledge in the disciplines for 'exotic subjects' or on parts of the humanities. The point also affects wide areas of all other disciplines, insofar as 'pure' science is driven there, i.e. science without a direct link to practical application. This applies to large parts of the social sciences (sociology, economics, political science), but also psychology, formal sciences (logic, mathematics), and even the basic areas of the natural sciences are affected (such as the basics of quantum mechanics). Some of these areas of knowledge would perish in the economic system, it could only continue to exist as gentlemen's science. Another part of basic research would have the chance to remain in existence through demand from larger companies. Large companies carry out strategic planning, in which only expected scientific results are also included. Here you quickly come to certain basic research that has a high application relevance. Securing a knowledge advantage, even if only probable, in such relevant areas is enough incentive for a certain demand. In fact, large firms are increasingly hosting facilities where basic research is carried out.

The reference to unprofitable basic research, which would be omitted in the economic system, does not initially mean that this system will deliver less output. The

[13] Except, of course, the organization of the market itself.

funds for basic research could be invested in practically relevant research and it could be that the practically relevant results more than outweigh the basic results, so that overall even an increase in output would arise.

Here, newer insights from the theory of science can now be brought into the discussion. According to this, certain areas of knowledge, which are often referred to as theories, or theoretically-technically networks of theories, are arranged tree-like, with a single, basic node, over which a tree-like network of increasingly special nodes branches out. The closer we get to a branch tip, the hypotheses located there, are more application-relevant, because they are more concrete. The development of such trees takes place, at least in the natural sciences, from the general to the special. Historically, the basic node is introduced first, from which successive specializations are made.[14] The width (the number of branchings) and the depth (the length of the branches) of such trees are in a harmonious relationship, just like real trees.

The limitation of basic research discussed above means in the tree model that little is happening close to the basic nodes of the trees; all growth is concentrated on the branch tips, where the practically relevant hypotheses lie. The model now further teaches that such growth can only yield more in the short term. After a short time, if new starting points for branches have not formed on lower levels all possibilities to form new branch tips are exhausted. This model is compatible with the data from theory of science but has not yet been extensively tested.

More generally, knowledge is organically generated in a way that manifests itself in the historically grown knowledge structures. If this composition is changed by external influences, the growth of knowledge is reduced. These considerations suggest that a displacement of the peer review process through commodity exchange in science would reduce output in the longer term. Research performance, therefore, does not provide an argument for the economization of science.

The *steering question* was whether science achieves better results if the selection of research objectives and the arrangement of scientific work for given goals are carried out in a commodity-oriented manner. There is no doubt that the answer to the second part of the question is positive. In the case of predetermined goals, the most efficient, known method is to direct the work to achieve them by economic means. The problem lies in the first part of the question, in the selection of goals.

There are two aspects to consider here. First, with strong leadership with predetermined research goals, the creativity required for scientific work is also kept within narrow limits. Female researchers are well trained and educated and, in these respects, are often superior to the chiefs who issue orders. They can better weigh whether their situation in competitive pressure requires a maximal effort and their replacement will or would lead to significant friction losses. This suggests that the aspects that cause the steering of employees in the 'normal' economy does not apply in the same way in the scientific field.

Secondly, the argument put forward on the question of efficiency also militates

[14] See, for example (Balzer, Moulines, Sneed, 1987), Chap.4 and 5, as well as (Balzer, 1998a).

against the fact that exchange and commodities can lead to a better selection of scientific goals than in the previous system. The point is again that in the market for scientific products, many of the currently pursued goals have no demand. Target selection by market mechanism would eliminate many goals in basic research and in non-practical disciplines. The result would be a short-term boom on the practical 'periphery' with long-term stagnating innovations due to a lack of new foundations. The answer to the steering question therefore also speaks against the full marketing of science.

Finally, the question of s*tandardization* was concerned with whether the influence of non-scientific, above all legal criteria in the formulation and standardization of results and products, is suitable for increasing scientific output. In the case of commodity-centered handling of scientific products, formulations of legal enforcement of knowledge and procedures are indispensable, because otherwise, the corresponding rights of disposal become too blurred and thus too little calculable. In the development that has already taken place, patent law, together with the lawyers living from it, has experienced a rapid upswing and everything indicates that this development will continue. It should be emphasized that the better enforceability of rights of disposal is not a scientific reason. Taking into account the two questions considered above, the better enforceability of rights of disposal will hardly be conducive to the scientific system.

In contrast to the world of cleanly separating legal paragraphs, there is a kind of creative chaos in the currently existing research system. Researchers are not interested in enforceable formulations. Rather, they try to publish their results as quickly as possible, even if they are often not yet solidly tested. As the reactions to axiomatizations show, many researchers consider a complete clarification of their findings not only superfluous but even harmful. Too precise a determination is perceived as a restriction in the creative search for something new. This should be obvious without further explanation.

An established standardization system for knowledge exists in the various subject didactics. Many researchers are also not interested in didactic presentation and work, because this would cost too much energy, which would then be lacking in the creative period.

It is undeniable that certain norms are socially very useful,[15] but the points raised show that the process of normalization subtracts resources from research. If, moreover, standardization is not carried out for scientific reasons, but in order to make rights of disposal more enforceable, the increasing legal standardization will not have a positive effect on science. The answer to the third question must therefore also be answered negatively.

In summary, it can be said that the answers to the three critical questions speak more against than in favor of subjecting science fully to thinking and acting in commodities. In addition, it was already stated in secction 3 that the reasons for success

[15] A prime example is the lack of standardization in the software sector.

named by the exertion of power and heritability are also present in science, but in a much weaker form than in the economy.

5 Success and enforcement of standards

In order to understand why, despite the lack of objective reasons set out above, the economization of science is vigorously pursued, we must take into account the role of norms. In order for exchange and rights of disposal to be possible at all, comprehensive systems of standards must be valid in society. Indeed, the concept of commodity itself is permeated by normative elements; the concept is socially constructed. In the first and third of the above conditions for commodities, norms play a constitutive role. As a pattern of action, the exchange of commodities is by no means as natural and fundamental as it seems to us today. In various societies, the exchange of commodities takes place in the form of gifts[16] or by simply taking away - with robbery as an extreme form. Ethnologists reported, for example, 'exchange attempts' between individuals from two man-eating tribes in Guinea, which often proceeded in such a way that the one individual after a short struggle together with the offered 'commodity' also took the body of the provider as food. Exchange is 'natural' only at the level of close relatives and friends.[17] An exchange between strangers, as it is routinely practiced today, must be understood as a special and less robust institution that developed slowly over long periods of time. It can only be maintained if almost all parties involved accept and follow certain norms.

On the one hand, these standards concern the rules to be observed in the exchange: 'offer does not oblige', 'exchange agreement obliges', 'performance and consideration are to be provided', 'no commodities without prior payment' and the like. On the other hand, they concern the entire legal and police apparatus that defines, decides, prosecutes, and punishes violations of the norms. The legal apparatus includes, in particular, the laws that define property and rights of disposal and regulate the handling of them.

This leads to the third condition for commodities, the right of disposal. Property as a special form of a right of disposal is obviously a normative phenomenon. But also more general rights of disposal are conditioned by standards since they are determined by contract. The description of the various permissible forms of contracts, as well as the regulations for their compliance, are the subject of civil law.

Since the concept of commodity is normatively constituted in this way, the success of commodity-oriented management depends on the validity and enforcement of the corresponding norms in society. If the standards governing exchange and disposition are not complied with, the reasons for success listed above lose their effect. Conversely, the standards give more stability to the reasons for success. These connections express

[16] Compare (Mauss, 1978).

[17] This is confirmed by socio-psychological models, for example (Blau, 1964).

in other terminology that commodities are socially constructed.[18]

We can accept the success of the economy based on exchange and commodities as a fact. If we consider the quantity of all material commodities and all the interactions involved in such interactions, then today the vast majority of this quantity consists of commodities. It follows in particular from this that the subsystem of commodity economy was also successful in enforcing the standards required for the handling of commodits in society, i.e. to bring the vast majority of the population to comply with these standards. This has led to the fact that in addition to many material objects, ideas, and, via work contracts, also many types of action have been incorporated into the area of commodities. The principled, ethically justified restrictions (the right to dispose of one's own body and basic freedom and property rights)[19] only partially function in the real world, as women's, children's, organ trafficking, or debt bondage-like conditions in the Third World impressively demonstrate. So many things and forms of behavior have now become commodities that it makes more sense to look at the exceptional areas.

What can be said about the emergence and justification of commodity-constituting norms in society? There are two different points of view here, which at the same time represent two research directions. Representatives of the game-theoretical approach[20] believe that the introduction of systems of norms brings relative advantages[21] to all participants so that their development follows the pattern of the theory of evolution: new variants are introduced more or less randomly and spread if they do not give the participants incentives to deviate. According to the second view, systems of norms are the expression of power hierarchies. They are introduced and enforced by smaller but more powerful ('upper') groups, mainly to consolidate their power over the less powerful and larger ('lower') groups in society and to make the exertion of power more efficient.[22] These two approaches have distinctly different implications when it comes to the normative demarcation of commodities. According to the game-theoretical harmony model[23] for the development of norms, the norms serve for the definition and handling of commodities for the utility of all parties involved, all those who deal with commodities. According to the power-oriented understanding of norms, on the other hand, these norms are largely oriented towards the interest of the upper social groups.

With the currently very thin data situation, the second, power-oriented approach seems more convincing. On the one hand, game theorists have to admit that there are hierarchies of power and that many existing laws do indeed favor the upper groups. In concrete terms, this ranges from the impotence of the state to prevent richer people

[18] See (Searle, 1995) and (Tuomela & Balzer, 1999), (Balzer & Tuomela, 1999).

[19] See for example (van Parijs, 1995).

[20] For example (Taylor, 1976) or (Schotter, 1981).

[21] In the game-theoretical model, a system of norms corresponds to a Nash equilibrium point in which no participant has an incentive to deviate.

[22] See, for example, (Balzer, 1993).

[23] (Balzer, 1993) justifies this designation.

from tax evasion and correspondingly lenient treatment of the rich who remain in the country, to differences in the judgments on criminal offenses, where dependencies on the wealth and position of the accused, and the effort of lawyers, can be seen.[24] On the other hand, it can be said that game theory has not yet succeeded in satisfactorily grasping the more interesting norms surrounding property, rights of disposal, and enforcement of interests through its models. For these reasons, we give more weight to the power-theoretical view.

A system of norms has also been established in science, which on the one hand determines the importance of many things in the scientific world and on the other hand is filled with life through scientific practice. Analogous to the concept of commodities, the concepts of knowledge, scientific achievement or reputation, or of the planned and successfully carried out experiment are normatively imbued or socially constructed. According to a much-noticed canon compiled by (Merton, 1957), the norm of universality applies in particular in science ('knowledge should be publicly accessible'). However, the whole canon, which does not need to be reproduced in detail here, seems to reflect more the state of gentlemen's science than the current one, increasingly dominated by the economy. It is therefore usually regarded by today's sociologists as outdated or not valid.[25]

On the normative level, the economization of science means that scientific norms are largely replaced by economic ones. In a fictitious final state of development, for example, the scientific value would be definable by the dollar and penny of the corresponding object on an underlying market; knowledge would be expressed by sentences for which a positive price can be achieved in exchange. The point that matters here is that the development of normative systems is generally only loosely linked to material or otherwise rationalizable developments. Due to their social construction, systems of norms contain a considerable degree of arbitrariness that cannot be reduced to any material or rational basis. The effect of 'objective', unconstructed reality is only evident over longer historical periods in which evolutionary advantages over alternative systems of norms become apparent.

Against this background, the current wave of privatization and economization is best understood as a movement in the realm of the socially constructed. Influential social groups believe that certain practices in the field of science should be changed ('constructed differently'). One political reason for this is the finding that academic science maintained by the state does not adapt to the extent desired by some to the economic dynamics. However, this dynamic has only become possible through the unleashing of research activities in the true sense of the word, namely through the extensive renunciation of the control of applications of scientific findings by society. The medium-term consequences that can be expected from this (the description of which we cannot go into here) cannot be compensated for by any brilliant, short-term production, export, or location balance. For contemporaries who think philosophically

[24] The examples can be multiplied arbitrarily.

[25] See, for example, (Barnes et al., 1996).

and in larger contexts, there is every reason for distance and skepticism.

End

The performance of the ideal exchange economy as a control principle for science was compared in three dimensions with the performance of the existing science system and found inferior in all points. A science conducted through the exchange of commodities would produce less knowledge, and its steering would result in more frictional loss; the necessary legal standardization would divert essential forces from the production (of knowledge). An analysis of the systems of norms necessary to maintain different social behaviors and the role of these systems of norms shows that the social pressure towards the economization of science is not rational but conventionally justified.

The skepticism resulting from the study towards the marketing of science is further reinforced by the following remark. In comparison, a exchange economy was assumed in an ideal-typical form, i.e. in the most positive expression which is adopted in economic textbooks. However, it is well known and acknowledged by economists that there are hardly any free markets in the real world. Distortions in property rights, the formation of large corporations, and the protection of them from competition override the efficiency of the market in most sectors of the economy. Important decisions in large companies are less and less determined by economic rationality. Without technical progress, the system would already have solidified. If the internal scientific steering mechanisms are already superior to the ideal market principle, this superiority over the increasingly corporatistically rigid social structure of the economic leaders is likely to increase many times over.

Bibliography

Austen-Smith, D. & Banks, J. S.1999: *Positive Political Theory* I, Ann Arbor: The University of Michigan Press.

Balzer, W. 1993: *Soziale Institutionen*, Berlin: de Gruyter.

Balzer, W. 1994: Exchange versus Influence: A Case of Idealization, in B.Hamminga (ed.), *Idealization VI: Idealization in Economics*, *Poznan Studies in the Philosophy of the Sciences and the Humanities* Vol. 38, Amsterdam: Rodopi, 189-203.

Balzer, W. 1997: *Die Wissenschaft und ihre Methoden*, Freiburg, Karl Alber.

Balzer, W. 1998a: Scientific Problems and their Role in the Evaluation of Science, *Agora* 17, 25-38.

Balzer, W. 1998b: Ranking Political Systems: The Aristotelian and an Institutional View, in N. Avgelis und F. Peonidis (eds.), *Aristotle on Language, Logic and Science*, Thessaloniki: Saccoulas Publ.

Balzer, W. 2001: Freedom and Equality in the Comparison of Political Systems, *The Proceedings of the Twentieth World Congress of Philosophy*, Volume 11 (ed. D.M.Rasmussen), Philosophy Documentation Center, Bowling Green, 173-178.

Balzer, W., Moulines, C. U., Sneed, J. D. 1987: *An Architectonic for Science*, Dordrecht: Reidel.

Balzer, W. & Tuomela, R. 1999: Eine Theorie des Gemeinschaftlichen, *Facta Philosophica* 1, 55-76.

Blau, P. M. 1964: *Exchange and Power in Social Life*, New York: Wiley .

Barnes, B., Bloor, D., Henry, J. 1996: *Scientific Knowledge: A Sociological Analysis*, Chicago: University of Chicago Press.

Debreu, G. 1972: *Theory of Value*, New Haven: Yale University Press.

Mauss, M. 1978: Die Gabe, in: M. Mauss, *Soziologie und Anthropologie* Bd.2, Frankfurt: Ullstein, 9-144.

Merton, R. K. 1957: *Social Theory and Social Structure*, New York: Free Press.

Osborne, M. J. & Rubinstein, A. 1994: *A Course in Game Theory*, 4. edition, Cambridge MA: MIT Press.

Schotter, A. 1981: *The Economic Theory of Social Institutions*, Cambridge: Cambridge University Press.

Shulman, S. 1999: Patent Absurdities, *The Sciences* 39 (1), 30-33.

Searle, J. 1995: *The Construction of Social Reality*, London: Penguin Press.

Taylor, M. 1976: *Anarchy and Cooperation*, London: Wiley.

Tuomela, R. & Balzer, W. 1999: Collective Acceptance and Collective Social Notions, *Synthese* 117, 175-205.

van Parijs, P. 1995: *Real Freedom for All*, Oxford University Press: Oxford.

Wartenberg, T. (ed.) 1992: *Rethinking Power*, State University of New York Press: Albany.

Williamson, O. E. 1983: *Markets and Hierarchies*, New York: Free Press.