**Working Paper**

# The theory of regulation

## A suitable methodological frame for the analysis of environmental problems

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## Abstract

In this paper, we address some fundamental questions concerning the search for an analytical frame for the assessment of the contribution of nature to economical development and specifically the role of nature as a productive factor in industries. We assume that the different capital stocks (e.g. natural and industrial capital) are intrinsically linked. The task is to highlight and analyse the mutual effects between industrial and natural capital in their historical context in order to be able to draw conclusions about their structural interdependencies. To examine the long-term influence of capital decisions in industry on natural capital (of a country, a region, a sector) and vice-versa, we will use a system-analytical approach which is known as the "theory of regulation". In contrast to the neo-classical theory, which deals with the analysis of short-term economic processes, the theory of regulation aims at an explanation of the long-term development of economic systems. The initial hypothesis of this approach, its main methodological orientations and their suitability for the analysis of the issue at stake are the main topics of this paper. Our intention is to stimulate the development of an alternative to the (in our opinion methodically unsatisfactory) approach of placing the decrease in natural capital (external effects) in the centre of the discussion. We believe that the upward revaluation of natural capital as a source of economic wealth is suited for elaborating the benefits of an intensive strategy with respect to the utilisation of natural resources.

## CONTENTS:



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# 1 Introduction

In this paper I will discuss questions which are intended to contribute to the methodological clarity of my Ph.D.-thesis on *"Factors influencing capital decisions and environmental policies in Europe – The role of nature as a productive factor. Case studies: The pulp industry in Germany and in Portugal"* (working title).

The assumption that there is a relationship (of whatever kind) between natural capital and economic development includes the solution to several questions indirectly concerning the term "value" that are yet to be answered, such as

a) how can the contribution of natural capital for economic development be assessed? and

b) how does economic development influence natural capital?

There are two main methodological approaches[1] (which probably differ rather in their philosophical point of view than in their content) that offer answers to these questions: The first one supports the hypothesis that the aim of economic activities should be (besides fair distribution of goods and aggregate economic efficiency) a "sustainable" preservation of natural capital. Assuming this, DALY (1992: 185 ff.) made a decisive contribution towards a more systematic concept of the so-called "Ecological Economics".

Although Daly's concept of "Ecological Economics" is not generally questioned, it only shows how it should be, and suggests that the economic system lacks an appropriate regulatory mechanism which assures a long-term preservation of nature goods. But it offers no analytical tool for the explanation of the type of distortion that hinders market regulation.

Of course, the question of how an effective regulatory mechanism should look has been food for thought for economists of all theoretical colours. In dealing with this question, the main stream (neo-classical) school has created a separate field of research, referred here to as "Environmental Economics" (in contrast to above mentioned "Ecological Economics"), which generally accepts the decisive importance of the environment for an economy. This approach is mainly based on the concept of external costs that are responsible for market distortion. The economic aim, according to this approach, is the creation of efficient market structures (through internalisation of external costs) in order to ensure an optimal level of aggregate economic welfare.

With the concept of externalities in the neo-economic theory, the material base of production by economics is perceived from the reverse side of the industrial value-adding process – i.e. through the decrease in value of material in connection with the phenomenon of waste and emissions. This perception of nature leads to the conclusion that environmental protection reduces current productivity growth. The benefits of those measures are mainly allocated to future generation. Therefore, the accumulated, past and current benefits of nature use (and abuse) for the present generation are systemically under-estimated by economists.

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[1] Two more approaches, albeit extreme positions, will not be considered here: firstly, the approach assuming a "weak sustainability" which postulates the more or less infinite possibility to substitute natural resources by other goods (the basis for this approach is the belief that a market economy is generally able to create price stimuli for the production of artificial natural resources or for the protection of non-substitutable resources); secondly, the approach of those favouring an "eco-dictatorship", demanding a general submission of the economy to ecologically oriented limits (cf. RENN, 1996: 32-34).

As an alternative to the (in our opinion unsatisfactory) approach of placing the costs of environmental degradation in the centre of the discussion, we stress the argument that the upward revaluation of the role of nature as a source of economic wealth and is suited for elaborating the benefits of a sustainable strategy for the use of natural resources.

# 2 Cybernetics and system theory

Cybernetic approaches normally provide a fruitful basis for the examination of dynamic changes in complex systems. To explore their potentials, we wish to expose some important basic concepts of those types of methods. Also, the definitions and assumptions of the theoretical model which provide the basis for the empirical part of this study are explained in the following chapters.

Cybernetics is the science of controlling and regulating, i.e. purposefully influencing, systems as well as information processing and its automation, which form the essence of the controlling and regulating processes. Cybernetics can be applied to any system and its purpose is to discern the regularity of controlling and (self-)regulating processes as well as information processing processes in nature and technology, and then to purposefully employ these processes for synthesising technical systems or for improving natural systems.

In order to analyse disturbances affecting the ecological-economical regulation it is useful to go back to the basic concepts of cybernetics: information, control and feedback. Regulation within cybernetics (sometimes referred to as organisation or co-ordination) specifies how the components (subsystems) of a system interact, and how this interaction determines and changes the structure of this system. It defines the difference between parts and the whole, and it is described without any reference to its material shape.

Disturbances in the regulating processes result from

- lacking or misdirected information between the subsystems,
- lacking or insufficient working control mechanisms,
- lacking or misdirected information about feedback effects.

The following questions enable focus to be placed on a system-based theoretic analysis of economic factor markets:

- information flows between the ecological system and the economical system (e.g.: which kinds and quantities of specific natural resources are available?) and within the individual system (e.g.: how is the use of common goods regularised?).
- quality of the controlling mechanisms (e.g.: how will nature respond to a decrease in natural resources? Will its capability to regenerate and assimilate be maintained in a way needed to retain the “safe minimum standard”?), and
- feedback effects (e.g.: what will happen in the overall system if a resource is becoming scarce? Will the stress symptoms of an ecological system be perceived in time by the economical players, will they react to it in a rational or irrational way, or will they even ignore it?)

## 2.1 Cybernetic approaches in economics

Recently, innovative impulses to the analysis of the relationship between the eco-system and the economic system have been given by evolutionary economic approaches (see for example: BINSWANGER/MINSCH, 1992, FRITSCH, 1992, BECKENBACH/ DIEFENBACHER,

1994). Further, the revival of different philosophic bases of economy, which have been edged by the hegemony of neo-classical theory in this century, offers a wider perspective for research today (FABER et al, 1983; BHASKAR/GLYN, 1995, HEIN, 1995, MARTINEZ-ALIER, 1987, HUEBNER, 1989; RENNINGS, 1999). And finally, the rediscovery of historical approaches as a method for the economic analysis has broadened the traditional field of research, too (JÄNICKE, 1998; KRABBE, 1996, INNIS, 1995, BRUNS, 1995).

For the purposes of this study, we depart from the general assessment that the long-term development of an industrial sector is, to a large extent, dependent on decisions of industrial capital allocation (investment). This is especially true for investment in the technical equipment of production facilities which, on the other hand, has a tremendous influence on the entire organisation of the enterprise and factor allocation (including the use of natural resources). The concrete economic background of the links between industrial technical capital and natural capital is the contribution of specific natural resources to the value-adding process in industry.

Regarding economic development from a cybernetic point of view requires the re-definition of some key concepts of economy, like capital and value. Capital goods are always "*stored values*" (HICKS, 1946: 170). Industrial capital and natural capital are values that can be stored in different forms. In this study, we understand "capital" to be potentially productive assets which industrial owners[2] use to achieve the goals of production. These assets are money, physical capital stock (machines, buildings, pool of vehicles, etc.) natural capital goods (soil, forest, water) and human capital (labour and know-how). We refer to "natural resources" as parts of natural capital that are used as production factors in industries. In industrial production, due to natural, technical and organisational transformation processes, the flows of energy, materials and labour engaged make the value of the capital initially invested change both quantitatively and qualitatively.

In order to look into the process by which the "value" of a good is created and composed, the concept of "value" will be determined, in this study, by means of a production function that is based on the concept of value-added. In this paper, we will deal with the essential theoretical aspects on which that function is based. In this respect, we should keep in mind that the theoretical model presented can be methodically understood as being an "ideal type" in the terms of Max Weber (cf. BRUNS, 1995: 124 ff.).

We assume that the different capital stocks (e.g. natural and industrial capital) are intrinsically linked. The evolution of one capital stock can not be understood without considering the reciprocal feedback mechanisms of the other. The aim of this study is to examine the long-term ecological impact of industrial development, i.e. the changes of natural capital caused by economic decisions, while taking into account the fact that each decision-making process in industry is influenced by the state of the natural capital at that actual moment, too.

## 3 The theory of regulation

In order to examine the long-term influence of capital decisions in industry on natural capital (of a country, a region, a sector) and vice-versa, we will use a system-analytical approach which has been known in English and French-speaking countries as the "Theory of Regulation". It was created in France at the beginning of the seventies as an attempt to

[2] Capital owners possess monetary and/or physical capital stocks. Materials and energy, labour and know-how are production factors which capital owners buy on the respective factor markets. We see "markets" as institutions where property rights on goods change the ownership.

describe and explain a certain period of development of capitalism[3] (Fordism[4], or more exactly the transition from Taylorism to Fordism). The aim of the regulation theory is to allow an analysis of the relationship of production and distribution, exchange and consumption. In its subject, the regulation approach therefore resembles traditional topics of economic theory; in its goals, however, it goes beyond traditional theories of production and allocation (HÜBNER/MAHNKOPF, 1988: 8-9).

The methodological sources from which this approach has originated are, on the one hand, biology and cybernetics, or general systems theories using concepts of *self-organisation*, and, on the other hand, economic theory itself: "The assumptions on the individual economic agents, their utility and behavioural functions, the provision of the economy with information and the central mechanism of market prices as a point of allocation, which are included in the concept of general equilibrium, are nothing less than explanations for an economic theory of self-regulation"[5] (HÜBNER/MAHNKOPF, 1988: 9-10). The content of the regulation approach comprises both the methodological individualism of neo-classical theory (cf. HORBACH, 1992: 38) and the classical value concepts of Smith, Ricardo and Marx, as well as Keynes' macroeconomic analysis, and Schumpeter's works on innovation.

### 3.1 Basic model

The following fundamental thoughts form the conceptual starting point of regulation theory:

- Social systems are subject to constant change. There are phases of relative stability, in which the existing structures are able to co-ordinate the system, keep up their dynamics, reproduce themselves, or make new structures fit into the existing system. But there are also times of radical turnover (crises), in which tried and tested co-ordination mechanisms get out of control. A new, stable state can only be established if new forms of communication (which guarantee the self-regulation of the system) are created between the individual subsystems and upper level systems. Small cyclical crises are generated inside the system itself, and if they do not lead to the breakdown of the whole system, they can also be regulated endogenously (by and within the system) by transformation of the existing system structures. Major crises also arise from the dynamics of the system, but unlike small crises they can only be overcome by the formation of new structures and forms of organisation which replace the old ones.

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[3] Capitalism here is regarded as a market economy whose economic regulatory framework is based on the existence of private property rights and competition. In capitalism private capital prevails and, particularly in the productive sector, capital ownership and labour are normally separate from each other. The dynamics of the system are determined by the conditions under which capital is brought into play – the so-called accumulation imperative. The accumulation imperative is forced upon the economic agents through the sanctioning mechanism of competition, which represents an essential regulatory mechanism of the system (see below). For further information about economic orders, cf. BROCKMANN et al, 1995; GERKE/RENNER, 1996, KURZ, 1997; for further information about regulatory framework, cf. AGLIETTA, 1982 and HÜBNER, 1989.

[4] The term of Fordism was coined by Gramsci (1967). He describes a system of mass production and mass consumption, whose social coherence is supposed to be ensured by a special network of institutional regulations (cf. HÜBNER/MAHNKOPF, 1988: 7).

[5] Editor's note: own translation.

- It is assumed that social (economic, institutional) systems develop historically and in an integrated way. For purposes of analysis, each phase of development can be defined by referring to the respective structures and co-ordination mechanisms which maintain the communication between the various subsystems. In doing so, different aspects are examined simultaneously:

  a) economic structures (as basic structures) and the institutional setting (as elements of co-ordination and cohesion of the system);

  b) the micro and the macro-level as mutually influencing levels where decisions are made;

  c) the historical dimension or different periods of evolution of partial systems (historical time vs. logical time of the neo-classical theory[6]);

In contrast to the neo-classical theory, which deals with the analysis of short-term economic processes, regulation theory aims at an explanation of the *long-term development of economic systems*. As it is assumed that in capitalism system structures and dynamics are mainly determined by options of capital owners (investment possibilities), the latter ones are usually also regarded and examined as the starting point of every analysis. This explains why the theory of regulation is characterised "by an empirical, selective problem approach, in which the development of theoretical concepts is driven forward by dealing with historically founded problem constellations. In this process of the creation of knowledge, categories are newly defined, working hypotheses are either examined in more detail or abandoned, and some representatives of the approach experience radical theoretical changes in position."[7] (HÜBNER/MAHNKOPF, 1988: 8). In the current state of research, the theory of regulation appears more like an "empirical, methodological and theoretical *research programme*" than a coherent theoretical concept"[8] (HÜBNER/MAHNKOPF, 1988: 14). In empirical studies, it serves mainly as the framework for the development of regional and sector-related structures.

In the centre of the theoretical analysis of regulation lies the question "how individual economic agents act within given structures, and how these aggregate economic structures emerge from the actions of individuals, or are changed by them, though effects on micro and macro levels are not a motive for action for the individual agents. *The process which provides, without this being intended by its agents, an inter-mediation between the micro and the macro levels of capitalist societies, is referred to as* ***regulation"***[9] (SCHMIDT, 1994: 4).

In this sense, the general mechanism of the regulation of capitalism therefore does not - as assumed by the neo-classic theory - induce or create an equilibrium, but rather "destroy the balance". Composed of complete competitive markets, the development of a neo-classical economy was simulated in an model experiment for verifying this hypothesis. This simulation was achieved by making a general equilibrium model run each successive stage of an ideal, perfect market economy in several periods. This experiment showed that such an economy

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[6] However, the "New institutional economics", acknowledging the concepts of the neo-classical theory, takes these aspects into account (cf. RICHTER, 1990). Evolutionary Economics departs from similar assumptions on the systematic relations in a society with the concept of time (cf. PASCHE,1994: 76).

[7] Editor's note: own translation.

[8] Editor's note: own translation.

[9] Editor's note: own translation.

tended, in the long run, toward “the excessive exploitation of human working power, the undermining of money and the lending system and the destruction of natural environment”[10] (Polanyi, 1978, cited as in HÜBNER/MANHKOPF: 23).

Throughout history, these tendencies of self-destruction were counteracted by the social system through a number of self-restrictions (rules, arrangements) in order to offset the imbalance tendencies constantly arising within the system. In its development, the capitalist system has the ability to generate a socio-political and institutional framework for the preservation of production and reproduction processes which ensure its further existence due to a high degree of adaptation to dynamics and change.

Based on these considerations, the theory of regulation claims the status of an alternative to the neo-classical, general theory of equilibrium, because this theory explains problems in the development of capitalism as the failure of accumulation and allocation processes, which are caused by "external disturbance variables". In contrast to this, the theory of regulation (HÜBNER/MAHNKOPF, 1988: 12) aims at

- showing the functional importance of economic crises for system adjustment processes by proving the endogenous character of accumulation blockages ("small" cyclical crises) and
- demonstrating that the adjustment capacity of a given political-economic system has its limits ("large“ crises), which can be overcome by radical social innovation concepts. Thus, the regulation approach promotes a concept of crisis which aims at an integration of inter-systematic change processes and those ”anti-systematic dynamics” coming from social forces.

In particular, this approach aims at proving the existence of historical, self-regulatory experience of successful and unsuccessful attempts of social systems to adjust to dominant macroeconomic processes. Some central questions of the theory of regulation are (HÜBNER/MAHNKOPF, 1988: 12):

- Which forces transform a social system and guarantee its long-term consistency?
- Are the terms and conditions of the current regulation mechanisms capable of guaranteeing the preservation of the whole system?
- Which conditions and which processes induce a qualitative change in the relationships of the production process?
- Is the identification of such forces, conditions and mechanisms suitable for explaining the structural crises of a production process?

The initial hypothesis of the regulation approach, which has been verified by a vast number of empirical analyses, can be characterised as follows (HÜBNER/MAHNKOPF, 1988: 14):

- Individual periods of growth are regarded as *accumulation regimes* which, over long periods of time, ensure a congruent transformation of production and consumption norms.
- Furthermore, these accumulation regimes ensure the coherence between the different elements of the economic and institutional organisation of a society - by way of specific *regulation mechanisms* (how wages are determined, how decisions on goods are made, the policy of interest rates and all state interventions in

[10] Editor’s note: own translation.

general), which in their entirety constitute *the characteristic form of regulation* of a given accumulation regime.

Although the regulation approach differs from the neo-classical theory in its method, in practice it actually follows a "secret orientation of equilibrium ", too: "The stable reproduction of social formations over longer periods of time is, after all, the result of an equilibrium of structural variables. What is, different to neo-classical approach, however, is that such states of equilibrium are not seen as the result of self-regulation by the markets, but interpreted as combined action of institutional/structural forms"[11] (HÜBNER, 1989: 226).

### 3.2 Reproduction and dynamics

In the centre of the regulation there are therefore structural forms or institutional mechanisms prevailing in certain historical phases of development, which ensure a continuous reproduction of the basic economic structures of capitalism.

The term *reproduction* refers, in this context, to the cyclical process of capital. The term “cyclical process” (or “capital cycle”) describes the two inseparable faces of a coin: on the one hand the transformation of monetary capital into goods (*production*) and on the other hand the re-channelling of the production (value) of the goods into the sphere of circulation (again as monetary capital); this is effected by the demand for those goods (*reproduction*).

To a certain extent, reproduction is accomplished in the form of profits which are regarded as a means of measuring a successful or failed use of capital. On this basis, the reproduction process comprises the allocation of incomes generated by the production process, the exchange of these incomes against the goods produced and, last but not least, also their consumption (SCHMIDT, 1994: 2). Particular importance is attributed to the relationship between the two destinations of social reproduction, namely “capital creation and investment” and “consumption”.

The microeconomic concept of the theory of regulation departs from the assumption that individual capital owners will invest their monetary capital wherever they expect a maximum in profit. Sometimes it is sectors producing for secure markets, sometimes sectors whose markets are expanding as a result of innovation[12], sometimes it is activities in regions in which cheap labour or resources ensure high profit rates, or in countries in which the institutional framework (labour laws, bank credits conditions, tax system) create favourable terms for capital use. Such investment decisions are determined by the actual conditions created by the prevailing *accumulation regime* and the existing *forms of regulation*. The "*guiding variable for the accumulation process*" is the average profit rate which measures "the success or failure of individual capital decisions and whose development determines the general profit expectations and, thus, the investment behaviour"[13] (HÜBNER, 1989: 191).

The explanatory model used for the analysis of the dynamics of capitalism also offers an analytical framework to explain its crises: a reduction in the general profit rate leads to a restriction of the accumulation process and thus to a reduction of production and employment, i.e. to a crisis. Numerous empirical analyses of the various crises of capitalism in the 20th

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[11] Editor’s note: own translation.

[12] Here followers of the theory of regulation also resort to Austrian evolutionary economic theories, particularly on Schumpeter’s theory of development in which a "dynamic entrepreneur", who carries through innovations with the help of bank loans and is able to pay the interest with pioneer profits, plays a central role (dynamic productivity theory of interest).

[13] Editor’s note: own translation

century (crisis of modernisation in the 20's and 30's, temporary overcoming of the crisis by the military-influenced Keynesianism; crisis of Taylorism and overcoming it with the help of Fordism in the 50's; crisis of Fordism in the 70s, overcoming it by the strategy of globalisation and flexibilisation) have contributed considerably to developing the regulation approach (LIPIETZ, 1998, BOYER/DRACHE, 1996, AYRES, 1996, STOCK, 1996, PFISTER, 1994, HIRSCH, 1980).

### 3.3 Two variants of the theory of regulation

Two major schools of the theory of regulation emerged during this process (KREBS, 1998: 6). While the *value-theoretical regulationists*[14] hold to the laws of production, the *price-theoretical representatives* of the regulation approach[15] generally question these laws. But both are interested in so-called "historical laws", i.e. theoretical statements on the relationships between economic and institutional variables in certain phases of development (HÜBNER/MAHNKOPF, 1988: 13). In the following sections, the most important pillars of the two schools of the theory of regulation are listed and then examined in terms of their usefulness to the subject of this study.

#### *3.3.1 The value-theoretical approach*

This approach is based on the assumption that only the usual production factors – capital and labour – are used. A key word of this theory is the term *wage relation* (rapport salarial), which describes the goods character of labour on several levels: the theoretical core aspect of the concept of *wage relation* is "that it includes the parallel, if not necessarily simultaneous, transformation of working conditions on the one hand and life styles on the other. It is a synthetic notion which relates both to work organisation, qualifications and employment as well as to wages and social benefits" (PETIT, 1986, cited as in HÜBNER/MAHNKOPF, 1988: 14).

Of special importance for the understanding of this school of regulation approach is the above mentioned concept of *accumulation regime*, too, whose theoretical content comprises three basic aspects that reflect the links between it and the "wage relation" (GORZ, 1998, HÜBNER/MAHNKOPF, 1988: 15-16)[16]:

- use of labour in production – expressed in the relative shares of the production factors (labour and capital) in the process of technical production,
- wage determination – expressed in the share of the value-added which is allocated to labour (in relation to labour's technical contribution to the total value-added and in relation to the share allocated to capital)
- reproduction of the social group of people dependent on wage – expressed in "life style indicators" (e.g. the relative share of wages expended for basic consumption and for capital goods)

Another important term in this approach is the term *competition.* It is assumed that competition causes a permanent conflict of individual capitals on the distribution of the entire value-added produced. Besides price competition, which happens in a sphere of exchange,

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[14] The early works of Aglietta are regarded as a revolutionary theoretical basis of this approach; cf. AGLIETTA, 1976.

[15] Cf. BOYER, 1986.

[16] The application of this approach to the use of the forest (or nature) as a production factor requires the adjustment and elaboration of these value-theoretical terms.

this concept of competition also comprises the production sphere in which individual capitals compete for the best comparative conditions in order to generate profit. The social transformation is strongly influenced by individual capital decisions which lead to the availability of above-average production conditions and are thus able to yield high profits. The effects of competition, as a dynamic process, are that an increasing number of capitals are forced to obtain these above-average production conditions, thus an ever-increasing percentage of goods are offered at the new price, and that - dictated by the new level of productivity and wages - there is a shift in the general level of prices. Individual capitals which are not able to follow this change in production conditions are crowded out of the market, which is devaluated (in this context the vicinity of this model to Schumpeter's becomes obvious).

The labour already "invested" by these capitals in the production of goods at first represents only a potential value [17]. Consumers on the market are forced to compare the prices of similar products. If they do not show a preference for certain goods, this means that they rate the price/utility ratio of these goods negatively in comparison to that of their substitutes. In this case, the potential value stored in the resources used in the production of these goods can not be re-converted into money. Analogous to the neo-classical theory this means that prices of goods are prices regulating the transformation of the conditions of production (HÜBNER/MAHNKOPF, 1988: 18). Indirectly this also means that the value of the labour (and other resources) integrated in those goods is not socially recognised as value-creating labour (or resources). The reproduction phase of an individual capital cycle is therefore the spot on which social values and political priorities concerning labour and environment become a concrete, historically relevant expression, since decisions on labour and resources for the next period are made on this basis.

### *3.3.2 The price-theoretical approach*

In contrast to this, the other school of the theory of regulation argues on a different level by avoiding resorting to values and arguing only that the price level is the "data level" which is relevant for the action of individuals. For the price-theoretical branch of the regulation approach, regulation is only located in the sphere of circulation and the theoretical fundament of analysis is no longer provided by the theory of (labour) value (HÜBNER/MAHNKOPF, 1988: 19). Therefore, this approach has more affinity with "new" neo-classical theories such as institutional economics.

Boyer belongs to this theoretical school, and, according to his own statements, bases his work on

a) the works of the German Historic School, and

b) the theoretical concepts of the Keynes-Kalecki[18] tradition.

Pascal Petit, who is regarded as representative of a third branch within the theory of regulation, links a neo-Smithian sequence:

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[17] To make a production cycle run, capital owners are obliged to spend money in advance to pay for labour and other resources. Thus, during the production phase, a part of the capital value is "stored" in factors of production. If the output of the production can not be sold at the end of the production cycle those "investments" will be lost.

[18] In his theory of the political economic cycle, Kalecki postulates the incompatibility of long-term full employment and capital accumulation.

*extension of markets → increase in productivity → reduction in prices and strengthening of competitive position → increase of domestic purchasing power → extension of markets*

with a socio-theoretical sequence according to Durkheim:

*division of labour → organic solidarity → development of the production system → division of labour*

According to Petit, the linking of both cumulative sequences with each other explains the concept of regulation as being a "conjunction of institutions and customs which, in a society, measure the reproduction of a given economic system by means of the articulation between production and consumption" (HÜBNER/MANHKOPF, p.22). This is common to all representatives of this branch: all aim at an integration of structure and institution/norm and emphasise specific economic and extra-economic co-ordination mechanisms between the spheres of production and consumption.

### *3.3.3 The role of the state*

For both schools of the theory of regulation, the state is dependent on the accumulation process on a national level, but it is also able to influence it decisively. The accumulation process directly determines the primary incomes - wage and profit - and thus also indirectly the taxes available to the state as the deduction from the primary income. If accumulation stops, taxes decrease, hence narrowing the economic-political handling capacity of the government. But exactly in such a critical situation, the state should make the accumulation process start again by credit-financed state government spending in order to prevent a crisis of the system (STRATMANN-MERTENS et al, 1991, RÜRUP, 1998). This concept of the state as final guarantor of accumulation does not only correspond with the ideas of the theory of regulation, but also with the current economic-political concept of global control (SCHMIDT, 1994: 11).

With regard to the role of the state, the theory of regulation is also directly linked to the Keynesian approach, stressing the special role of government instruments, like inflation control by public demand, interest and money supply policy, fiscal policy and decisions in international foreign currency markets. According to the theory of regulation, explanations for the globalisation crisis can be found here, too: "If, in times of Fordism, the state had, through its money and fiscal policy, influence on the amount of aggregate economic demand, it lost this role during the Fordism crisis to the international financial markets. The adjustment to the interest and exchange rates set there made the state a microeconomic player."[19] (SCHMITD, 1994: 12; see also: FUCHS, 1996:7-20, BOYER/DRACHE, 1996).

### *3.3.4 Which theoretical frame is the best one?*

All regulation-related theoretical approaches are equal in their attempt to treat central structures of the accumulation process as endogenous variables of a theoretical model. Above all, the value-related theoretical approach shows, in its specification of the decision variables of individual agents, a notable vicinity to the “methodological individualism” of traditional microeconomics (HORBACH, 1992: 38,) and to evolutionary approaches of Ecological Economics (cf. PASCHE, 1994). But today, most regulation-related theoretical studies are based on the Keynesian-Kaleckian interpretation of macroeconomic theory, while the value

[19] Editor’s note: own translation.

theoretical path opened by Aglietta is seldom used. Also, in Germany, price-related theoretical approaches have been applied for several years in the research of various regional developments within the globalisation process, which are termed “systemic competition” in literature (as for example HEIN, 1995; EßER et al., 1994, MESSNER/MEYER-STAMER, 1993).

Although the regulation approach assumes the unity of the production and the reproduction process, empirical examinations within the value-related theoretical variant of the regulation approach show a certain tendency to microeconomic aspects (SCHMIDT, 1994: 12), while the price-oriented approaches emphasise more the macroeconomic level (HÜBNER, 1988: 227). However, representatives of both variants agree that the actual innovative contribution of the regulation concept to the formation of theories and to the development of an instrument for the empirical analysis of capitalism lies in the close systematic integration of both levels.

There is no clear answer to the question of whether the theory of regulation needs the value-oriented theory or not. As HÜBNER states (1989: 80-81): “As long as regulation only refers to the integral whole of the functioning mode of institutional forms, regulation may be rooted in a theoretical sphere with or without the labour-value theory, for in this case, the analysis is based on the surface of the capitalist reproduction process. However, if one tries to put the form of reproduction of the determining structure in generally valid laws, the decision "with" or "without" value theory becomes important”[20], since

- firstly, value theory explains the structural independence of the production of exchange value (prices) in relation to the production of use value (integration of labour and resources in goods) and thus the systematic imperative of capital accumulation;
- secondly, it provides insight into a specific economic reproduction mechanism which is not consciously directed by the agents and which ensures the transformation of private production value into social value. This “socialisation of production value” happens through the creation of welfare - consumption, capital growth – and externalities (e.g. environmental changes).

According to HÜBNER (1989: 221), the frequent mixture of both variants of the theory of regulation contributes to "blocking the further theoretical foundation of the regulation-related theoretical approach"[21]. In his opinion, the price-theoretical variant is to be seen as a contribution to political economics, however, it lacks a sound conceptual foundation, and the mixture of this approach with value-theoretical principles created problems of coherence which could finally undermine the concept of regulation (HÜBNER, 1989: 222).

A. Lipietz takes a special role among regulation-related theoretical schools. His theoretical works are based explicitly on the theory of value; the empirically oriented studies, however, mostly refer to price-related theoretical approaches (HÜBNER/MAHNKOPF, 1988: 19). Lipietz (1998:12-13) regards an accumulation regime as a long-term allocation equilibrium between the options of social reproduction (capital formation and investment on the one hand and consumption on the other). For such a regime to be able to reproduce in a stable way, according to Lipietz, there have to be norms, habits, laws and regulating networks which ensure that the microeconomic agents behave according to the stability requirements of the regime. By their rational actions within this framework, they ensure the reproduction of the regime without consciously intending to do so. The structural integration of the micro-level and the macro-level, therefore, forms the core of the regulation.

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[20] Editor’s note: own translation.

[21] Editor’s note: own translation.

If one deals with current literature, it becomes obvious that representatives of the theory of regulation search less frequently for solutions for current problems than for explanations for noticeable trends and changes. What is particularly attractive about the theory of regulation, in my opinion, is that it makes the (spontaneous) self-regulation of an evolutionary process the centre of its empirical-economic analyses.

We commence by observing that, in the factor markets of the industrial countries, there are substantial co-ordination problems between each subsystem (in the present case, the ecological system and the economical system). For the purpose of analysing these disturbances, we go back to the basic concepts of cybernetics and consider the historical nature of the relations of society and nature (SIEFERLE, 1998: 304-307). An analysis based on economic history and a system-based analysis should ideally join together, as Hicks realised as early as 1946 (HICKS, 1946: 7): "It is only when both these tasks[22] are accomplished that economics begins to near the end of its journey"[23].

The historical-analytical method prevents the theory of regulation from being normative. Nevertheless, some authors showed that it can be extremely fruitful to use a value-related, theoretical, regulatory approach or variations on the Lipietz' approach by searching for (political, normative) solutions to current acute problems. Though they often do not explicitly mention the proximity of their own theoretical frame to the schools of regulation (for example BLEISCHWITZ, 1998, MASSARRAT, 1996, ALTVATER, 1993, HICKEL, 1987) the methodology used in those works reveals a significant theoretical proximity to the theory of regulation.

## 4 Practical outcome of the theoretical discussion

As shown above, the value-related, theoretical approach focuses on the role of individual production factors in the course of social evolution. Thus, a value-related theoretical model seems more adequate when examining the contribution of a natural resource to the creation of economic value than any price-oriented approaches. Furthermore, the evolutionary character of the term "value" is a basic assumption of the value-related, theoretical approach, and, at the same time, evolution is closely seen as a result of value changes. As mentioned above, the failure to sell goods produced in technologically backward industries means concretely, in the context of a value-related theoretical approach, a "devaluation" of the production factors integrated in those products. The consequence is a trend to perform the technical standards of the production or to shift capital and labour from those enterprises to branches with higher profit performance. Thus, an approach centred on the value-added concept offers an analytical frame for innovation research, too (cf. KEMP et al, 1999).

Regarding nature as a production factor, we aim to find out how (and why) the accumulation regime of the pulp and paper industry changed over the course of time, i.e. we will try to evaluate how the value of natural resources (wood) for the industry has changed. Because, in terms of row materials, the pulp industry is especially close to natural capital (forest), it seems

[22] Hicks means the "pure logical analysis of capitalism" and "the survey of economic institutions", which in his opinion is best carried on by other methods, such as those of the economic historian (editorial annotation)

[23] Already in 1956, Harold Innis probably unintentionally used a cybernetic approach to describe the economic development of Canada (INNIS, 1995: Part I, Chap.1, p. 5). FERRÃO (1987) carried on a very inspiring empirical study, on this basis, about the long-range development of the industries in Portugal.

particularly suited for the examination of these questions. By comparing the development of the value of wood as a production factor with that of the (exchange)value of pulp products, we hope to be able to explain the contribution of forests to the evolution of the pulp industry.

At the starting point, there is the question of how the relationship between (monetary) capital of the pulp and paper industry and the forest can be expressed. For this purpose it seems essential to assume that, from an ecological point of view, the relations between these two types of capital manifest themselves in the form of materials and energetic flows. For the analysis of further questions it is important to note that the pulp industry represents a central part of the paper production process. The pulp industry produces important intermediate products of the paper production – wood pulp and cellulose - but also recycling fibre.

The core statement of the theory of regulation, which is simultaneously the main hypothesis of this study, says that the options of capital investments are in a dynamic relationship to the ecological and social framework. As the technical equipment of the pulp industry has changed over time, and, thus, also the relationship of the industry to natural capital, the technological development paths of the sector need to be closely examined. The following questions are of special interest:

a) How has technological progress taken place?

b) Is it possible to identify individual phases of development (technological paradigma, market organisation etc.) which can be regarded as specific accumulation regimes of the sector?

c) How can the ecological impact of individual phases of development be assessed?

d) To what extent has natural capital influenced the preference of certain technical options and the crowding out of other options?

This part of the study shall form the historical-analytical basis on which, finally, with the help regulation-theoretical instruments, the role of nature in capital decisions in the pulp industry will be examined.

### 4.1 Reproduction and flexibility of capital

The cyclic character of the value-adding process of industrial capital lies in the repeated transformation of monetary values into non-monetary values (materials, products) and vice versa. In the reproduction stage (R), the material output of the production (P) is marketed, and during this process it is returned to the circulation stage (Z) in the form of monetary capital.

If the transformation yields profits, an increase in monetary value is realised in every individual capital cycle. With that the company has the monetary capital (M) - after a profitable transformation it is M‘ – at its disposal at the beginning of the next utilisation cycle. Effecting the surplus V is the micro-economical central mechanism of the accumulation of capital, which is characteristic of the economic development in industrial societies[24].

The monetary capital owner of an industrial company can choose from different options to utilise his monetary capital in the circulation stage (Z). Some part of the value-added (V) is kept by the capital owners as their private incomes (I) in the form of incomes from capital. For utilising the remainder of the monetary capital (M‘ – I) they can choose from the following options:

- Investments for modernising or expanding the company

[24] For a deeper understanding of the relationship between V, capital accumulation and growth see BIERVERT/HELD (1996).

- Purchase of capital shares of other companies
- Financial investments in financial and currency markets
- Expenditures for cost-cutting measures (intensive strategy for increasing V in the next production cycles such as rationalising the operations, taking environmental measures to avoid fees for waste disposal, etc.)
- Expenditures for improving the marketability of the products (improvement of design, advertising)
- Investments in strategic areas (R&D measures, measures for training the personnel, lobbyism in politics)

Although monetary capital owners do not necessarily act according to rational categories all the time, we may assume that their decisions regarding new investments, as a rule, are guided by global basic conditions of capital utilisation. In the industrial sectors, the branch structure and the capability for innovation (or the possible decline of a sector, respectively) crucially depend on the possibility for the monetary capital invested in the individual companies to reproduce. This is reflected in the structural change of industry: since the monetary capital usually aims at the best utilisation in order to increase its value, production processes and products having become obsolete fall prey to the competition of new, more efficient technologies and consumers' expectations for more modern design. This is the result of the system-immanent regulation of the market. In this context, the technical progress acts, as Schumpeter puts it, as a creative process of destruction.

As a rule, industrial companies have a greater capacity for action in the production stage than in the reproduction stage. In fact, in well-operating markets, companies act only as quantity adjusting units, i.e. they are, to a considerable extent, at the mercy of competition rules and the preferences of consumers. They can retain their competitive strength by measures taken during the production process, such as cost-cutting measures or product modifications. However, depending on the degree of concentration in the branch, individual companies can exert some considerable influence on the prices and fashion trends in sales markets. In this case, a comparably higher deployment of resources with respect to successful results in the reproduction stage is also an appropriate measure. This includes, for instance, advertising, common pricing with competitors, etc.

Capital is considered the most flexible of all production factors, because it is, in principle, bound to neither geographical nor political borders, nor to sectoral or product-related targets. The flexibility of capital, however, mainly results from the fact that capital can be "reproduced", i.e. after each transformation it is again available in the form of monetary capital for new investments. Tied-up capital (particularly premises, machines, infrastructures, but also employees and other contractual arrangements), by comparison, has an extreme degree of inflexibility.

Industrial facilities often are very capital intensive and are subject to long depreciation periods. This also restricts the flexibility of the monetary capital in capital intensive industrial sectors (such as the pulp and paper industry) to some extent, for several cycles of capital have to run successfully, simply in order to amortise the initial investments. The entire tied-up means (capital goods, employees, know-how and the market position achieved) act as a strong incentive in these industrial sectors for preferably making investments in one's "own house". However, investments for modernising the company's own facilities will be only made by profit-oriented monetary capital owners in industry, if they can expect rates of growth over a medium and long term that are higher than or at least as high as the average profitability rates on the global capital market.

Due to the comparably high degree of inflexibility of industrial capital, monetary capital owners in industry are very much interested in favourable basic conditions for the utilisation of capital in their sector (KNÖDGEN, 1982, GERNERT, 1990, OSÓRIO-PETERS, 1999, 1999a). The need for controlling the conditions for reproduction of the industrial capital usually leads to the creation of corporate organisations in capital-intensive industry businesses (i.e. establishing business associations, alliances with other strong monetary capital owners such as banks and insurance companies, a close network with political parties and public institutions). Well-organised industrial clusters act very self-confidently towards politics through their role as important taxpayers and employers, and they can exert some considerable influence on the conditions for reproduction for certain forms of capital utilisation (MESSNER, 1995). One method of achieving this would be to exert influence on politics in that long-term maintenance of a location for that specific sector would be particularly supported by the basic political conditions, or access of foreign competitors to the market would be handicapped by protectionist measures.

If we analyse the regulating mechanisms with regard to the conditions of production in a specific sector and the development of factor markets, we have to focus on the concrete relationship between the micro level and the macro level. As explained in more detail in the following section, companies will generally select the most favourable strategy for utilising their capital under the existing basic conditions, or try to change these conditions in their own favour. For this purpose we will base our analysis on a technical production function of the pulp industry in which energy and materials are explicitly listed as production factors. As the transformation of technical production functions into cost functions is not entirely unproblematic, some considerations on this issue will be demonstrated in the next section.

### 4.2 Extensive and intensive strategies for factor utilisation

The reproduction stage is mainly characterised by the process of co-ordination between supply and demand. These concepts cover extremely complex and interacting evaluation processes initiated on the part of the consumers as well as on the part of companies and politics. The entirety of these processes and their cybernetic harmonisation, which is not consciously initiated by the single players, has been called “regulation”. By this concept we understand the dynamic mechanisms that are behind the market and that have some great impact on decisions in the circulation and production stage.

In literature on economics we find information about regulating processes on the operating level particularly regarding the application of the “labour” factor. If a company having a production function of

$$Y = f\,(C, L, M, E)^{25}$$

wants to follow a profit maximising strategy successfully, it can choose from two main strategies: it can either expand its market supply or increase the value-added by production. Accordingly it can (FERRÃO, 1987: 19-39):

- put more goods onto the market by an absolute increase in production, with the inputs of the production also being increased proportionally (*extensive strategy*). This strategy, of course, will only be successful if the market accepts an extended supply. Limits to this strategy can also be set by the company’s own capacity limits, shortages in the factor markets or by institutional regulations. For the “labour” factor this

[25] L stays for labor, C for capital, M for material inputs and E for energy inputs.

strategy means an absolute increase in the output at a cost overrun that is as low as possible.

- increase the factor productivity (*intensive strategy*), for example by increasing the output per hour.

An extensive strategy was typically pursued in the early stage of industrialisation, and this changed not least because the industrialisation process itself triggered an increased demand by the increasing number of wage earners, hence allowing the marketing of an increasing supply of goods. Also at this stage, the establishment of labour unions and basic conditions with regard to social law had not taken place, allowing employers to pay very low wages and, at low standards of labour protection, also employ "cheap" labour forces (children, women, foreigners) in the production.

However, even in the advanced stages of industrialisation, some businesses would like to return to this strategy, especially in situations of expansion and crisis (COHEN, 1998, HENNICKE/MÜLLER, 1995). This can be seen in many examples of the development within Europe; for instance in Germany the waves of migration in the sixties and seventies, and later in the nineties the discussions on the law regulating the closing time of shops, the continuation of payment to sick workers, the setting-up of low-paid jobs tolerated by law, the increase in temporary employment contracts, etc....

As a rule, however, we may assume that in times that are comparably stable in industrial countries, companies rather pursue an "intensive strategy" that is suitable for achieving maximum utilisation of own profitability potentials. Rationalising, lean production, just in time, etc. are key concepts of this strategy.

In order to explain the strategy of obtaining gains in productivity, we will analyse the concept of value-added in more detail. The value-added of a production process is composed of the contributions of the production factors to the product value and thus correlates positively with the factor productivity. Analogous to the concept of value, the commercial productivity of a factor can be defined from one of the following perspectives:

- technical (e.g. labour time per unit of output),
- monetary (e.g. labour cost per unit price of output) or
- subjective (e.g. benefit per unit of output)

In this study, the concept of productivity (if not stated otherwise) is used from the technical point of view. With respect to the labour factor, we may assume that with comparably high and stable wages a company will try to obtain gains in the productivity of labour resources by applying technical improvements. This is also considered the main motivation for technical innovations in the industrial sectors which, in this century, has been demonstrated in many lines of business by the high degree of substitution of energy for labour (KÜMMEL, 1997).

With regard to the utilisation of other production factors, industrial companies face options similar to those in the case of the labour factor. However, substitution of raw materials from nature (energy or other materials) for labour is often only practicable within narrow technical and economic bounds[26.] As a result, the strategy concerning the utilisation of natural raw

[26] Most papers on this subject are concerned with substitution elasticities between labour and energy. In studies that analyse the substitution of labour and natural resources, sources of energy were also included in the aggregated category of "resources". Thus the substitution rates calculated on this data basis have presumably been affected to a high degree by the

materials has had a predominantly "extensive" character up until the present day (HINTEBERGER/WELFENS, 1994, BRINGEZU, 1994). But in this respect, the development in industrial countries has, at least for the last few decades, indicated a global transition from an "extensive" to an "intensive" strategy. Apart from the merely technical coverage of indicators that illustrate this development by specific examples, we wish to venture an insight into the present scientific perception of the ecological-economical resource issues.

## 5 From a cost-oriented concept to a value-oriented concept of nature

GEORGESCU-ROEGEN (1971: 277-282) tried to analyse the results of an extensive use of nature by means of the thermodynamic concept of "Entropy". His papers are an enriching (even controversial) basis for discussing traditional approaches of resource economics[27]. In economic terms, we may define the principle of the augmentation of entropy as follows (DALY, 1995): economic growth is accompanied by an non-detainable devaluation of material. BINSWANGER (1994) demonstrated the productivity of the entropy notion for environmental economics[28] in connection with the theory of the dissipative structures of Prigogines. In fact, the consequences of the irreversibility of environmental impacts on economic processes can only be deducted from the law of entropy. Just as BECKENBACH/ DIEFENBACHER (1994: 22-23) remarked in this context, it also becomes clear "that finally it is not the relative improvements in the productivity of resources that matters, what matters is improvements with respect to the overall quantities of production, leading to an absolute decrease in the (entropy augmenting) utilisation of resources".

At the definite end of a production and its respective consuming cycle an increase in the value of the capital has taken place – in economic terms –, but – in material terms – the final results of production are only emissions and wastes that cannot be utilised anymore. Those now have a negative exchange value (their owner pays for getting rid of them), regardless of the utility value or the risk potential that they have in material terms. Depending on the degree of cost internalisation ensued – i.e. depending on the amount of waste disposal costs – they are more or less completely classed with the current production costs, which means a curtailment of the profits. The waste disposal costs are thus the economical (even distorted[29]) response of an augmentation of entropy.

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high substitution potential between labour and energy that has been proved empirically for a long time now (cf. BLEISCHWITZ, 1998: 134-136).

[27] The utilisation of resources has traditionally been regarded from the perspective of the shortage of resources.

[28] In essence, the transfer of the thermodynamic concept to economical topics is a controversial issue. In the context treated in this study it is not the physical entropy but the entropy regarding the dissipation of materials which is referred to, i.e. the decrease in value of matter when it transits from a concentrated state to a state of diffused (not available) substances (GUGGENBERGER, 1991).

[29] Waste disposal costs are normally dependent on the shortage of disposal capacities and/or the environmental protection activities required for allocating the external effects of waste and emission disposal. Both assessment methods consider only indirectly and imperfectly

It is not surprising that the "rediscovery" of the material base of production by economics was first perceived from the reverse side of the value-adding process –i.e. through the "decrease in value of material" in connection with the phenomenon of "waste/emissions". This is also true for the perception of many environmental issues, such as the climate issue: in material terms, the actual causes of the ecologically noxious and climate-changing emissions lie in the chemical features of the sources of energy and – in economic terms – in the disability of economics to evaluate them. This is why for instance the wages earned and the profits that disposal companies gain due to the large quantities of disposed waste are integrated positively into the macroeconomic overall balance, which indirectly indicates that the systematic devaluation of material is assessed by economic statistics to be a positive contribution to economic development. Some conflicts that seem to emerge from fundamental differences of economy and ecology are in fact the fateful result from the methods of evaluation used by economists (MÜLLER/HENNICKE, 1994: 26-27). "The current methodology leads almost inevitably to the conclusion that environmental protection reduces productivity growth. Though this perception is reinforced by extensive empirical work, it is basically an artefact of the methodology now being used and is not necessarily correct" (Repetto, cited by BLEISCHWITZ, 1998: 114).

It is actually a self-evident truth that, in order to assure development, there should be a positive correlation between an upward revaluation of wages and an increase of labour productivity (cf. SVR, 1985: 177). This acknowledgement emerges from the recognition of the value of the factor "labour". However, the estimation of the wages/productivity ration depends on the methods applied for measuring productivity. These findings are not so much surprising because of their objective contents but because of the fact that they directly remind us of topics that have been known to economics for long. Hence, in the 19th century, regulations for industrial safety and demands for higher wages were basically regarded (and even today not rarely) as a handicap for increasing productivity. This attitude does not take into account the historical fact that it was only the upward revaluation of labour as a production factor that made the transition possible from early capitalism (with its strategy for an extensive utilisation of labour and its disastrous social consequences) to the success of the Fordism which was based on the prosperity of a wide section of wage earners.

The present-day, natural capital results from the permanent adaptation of the ecosystem to the social regulations that in the past made an incorporation of the value of nature possible by the extensive utilisation of nature (SIEFERLE, 1998). From the historic-analytic point of view, with regard to the utilisation of nature as a production factor, we are in a stage of early capitalism (extensive strategy) today. To analyse the mechanism that allows a transition to intensive utilisation, the recording and monetary evaluation of ecological damages does not seem to be a particularly productive way. As far as the other production factor (labour) is concerned, it was after all only the linkage of wage and productivity adopted by employers and employees that introduced a long period of growth in industrial countries. In the same way, the transition of an extensive to an intensive strategy in the utilisation of natural resources that we observe in some areas today (e.g. with the forests) is probably a sign of the self-regulating adaptation of the system to the negative ecological results of the previous strategy.

In this context, we wish to place particular emphasis on the fact that productivity is normally measured as related to factor incomes (wages and profits) – and not to the specific (technical) factor contribution to total value-added. This prevents economics from recognising the contribution of natural resources for the creation of wealth (BLEISCHWITZ, 1998: 128-130).

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the irreversible decreases of value by the augmentation of entropy due to the transformation and dispersion of materials.

Moreover, the indifference of economics with regard to the material nature of goods that are produced, moved and changed, fostered the development of environmental problems, because they were often perceived too late (false estimation of risk). Thus, it also prevented the development of analytic methods for a scientific treatment of this topic. If we interpret the man-made causes of environmental problems as a false estimation of risks and/or a result of externalising private risks costs, the necessity to cover the physical base of economic activities in a better way and include this base in the risk estimation with economic decisions will be evident (cf. FABER et al, 1994).

As an alternative to the (in our opinion methodically unsatisfactory) approach of placing the decrease in natural capital (external effects) in the centre of the discussion, we believe with MARTÍNEZ-ALIER (1995, 1996) that the upward revaluation of natural capital as a source of economic wealth is suited for elaborating the benefits of an intensive strategy with respect to the utilisation of natural resources. In this context, we wish to stress the argument that technical innovations mostly emerge from the need to improve factor productivity. The empirical evidence for this has been given by several studies (recently e.g. AUTTIO et al, 1996, EUROPEAN COMMISSION (ed.) 1997, KLEMMER (ed.) 1999, KÜMMEL, 1997, BLEISCHWITZ, 1998: 136, 137).

Since nature does not receive any monetary compensation (wage) for its efforts, we have to discover how the benefits from the contribution of nature to economic development has been allocated so far. Of course, any institutional arrangements aiming at a long-term conservation of natural capital may change the benefit-cost relationship among individual users of natural goods and be a source of conflict. In order to understand the issue at stake and to design a sustainability-oriented environmental policy, it is necessary to acknowledge the structural and dynamic interdependencies of man-made and nature capital. The economic research misses empirical studies in this field for the development of suitable tools. This paper aims at being a small contribution to fill this gap.

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