

Industrial Policy for Competitiveness and Sustainable Development

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CompETE

**Competitiveness,
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Abstract

The point of departure of this paper is the hypothesis that we are in the midst of a change in the techno-economic paradigm. What we perceive as new challenges in a globalized world economy are in fact symptoms of the search for a new paradigm. There is some probability that a key feature of a new paradigm will be ecological sustainability. Therefore, a policy that tries to shape the structures of the future paradigm will have to follow the lines of an industrial policy for sustainability. Industrial policy is a controversial issue; the pros and cons are discussed. The concept of systemic competitiveness and findings from innovation economics help understand why it is not sensible to leave structural change entirely to market forces. Industrial policy for sustainability has to be formulated and implemented at the local/regional, national, and supranational level.

1 What are the new challenges in world economy?

Current discussion in Germany focuses on globalization as a central element of the new challenges in the world economy. A prevailing feature is the globalization of financial markets in which huge sums of money are transferred around the world in next to no time. But it is not only money which is considered to be flexible in every way. A prevalent thesis is that companies, too, are free to choose whatever location they like. In consequence, differences among nations are supposed to disappear—high-wage countries will have to adjust wages, taxes, employers' contributions, and ecological requirements towards the bottom. This argumentation seems plausible because it can be illustrated with a number of empirical examples: relocations of production to low-wage countries outside the European Union, the foundation of new car factories on green field sites, and the like. However, the argumentation is too simple, and wrong in essence, because it underestimates the requirements which companies have with regard to locations and the ability of locations to meet them (Esser et al. 1996).

An alternative and more sensible approach is the question what the new framework conditions of world economy actually are. Innovation economists speak of a change in the techno-economic paradigm (Freeman 1987). Since the industrial revolution the evolution of the industrial mode of production has seen breaks which gave rise to new organizational patterns at company, branch and societal levels. These breaks are interconnected with far-reaching technological changes (technology as the sum total of technical hardware, know-how, qualification and organization, Meyer-Stamer 1997). The last one of these paradigms that has determined the development of the post-war period is being discussed under the label of Fordism (Hirsch and Roth 1986, Marglin 1990): with the general application of industrial mass production productivity and distribution potentials grew dramatically. Trade unions were able to secure growing real wages in the course of protracted struggles, which led to an overall increase in material living standards. The welfare state with comprehensive social security, in several variants, became the typical form of society in the industrialized world.

This growth model met its limits in the 1970s. The major factor that caused a persistent decline in economic growth was a considerable drop in productivity growth. The explanation is that the potentials for a further productivity increase in the framework of mass production had been exhausted. There were other factors, too, not least the enormous resource intensity of this model, which caused a high need in energy that was covered by import and provided the oil exporting countries with a strong negotiating position.

The last twenty years have been marked by the crisis of Fordism and the search for a new paradigm. Search does not mean of course that a group of social scientists and economists sit down together and figure out a new model. Just as Fordism had never been planned, the new paradigm, too, will be the result of decentralized, uncoordinated activities of numerous actors in differing spheres. Nevertheless, there are tendencies which help to identify the trajectory of future development. Such tendencies can be observed in several areas—there where new organizational and policy pattern have gained the upper hand over the past few years. A parallel

development are interpretive patterns, that is views and implicit theories which many actors share and which determine their beliefs of what is right and what is wrong—and consequently guide their actions.

To this extent it is possible to identify some features of the new emerging paradigm. Globalization, that is, a view of the world where the national state has ceased to be the central level of both economic activities and analysis, is just one of them. Others are:

- New competitive patterns prevail now in industry. Standardized mass production has been replaced by the manufacturing of differentiated products. The time factor has become crucial in competitiveness. New organizational patterns in companies (lean production) do away with traditional trade-offs (flexibility vs. efficiency, quality vs. efficiency, speed v. efficiency and quality) (Best 1990, OTA 1990). Ecology becomes more and more a competitive factor.
- Companies concentrate on their core competence, namely the activities which they know best. At the same time, they make higher demands on their direct environment, that is, on other companies (suppliers, subcontractors, manufacturers of capital goods, various services) and on the institutional environment (technology institutes, education, etc.). A well-developed location makes it possible to sustain profits and thus encourages the creation of competitive advantages (Porter 1990).
- Patterns of cooperative competition emerge at both local and global levels. At local level, regions that specialize in one or just a few branches and in which a multitude of formal and informal relations among companies produce cumulative learning processes often take a particularly dynamic development (industrial districts; Schmitz and Musyck 1993, Storper 1995). The significance of long-term supplier relations increases. Throughout the world there are indications that the importance of strategic alliances keeps growing (Hagedoorn and Sadowski 1995).
- New patterns also emerge in the field of political governance. Traditional hierarchical governance functions less and less, traditional governmental industrial policy is becoming rare. Networking, where the state acts rather as a moderator and a facilitator, is gaining in importance (Messner 1995).
- The significance of knowledge is growing (OECD 1996). Up to now, this has become evident above all at company level. Current discussion on management targets the mobilization of knowledge at all company levels (the "learning organization"), while the 19th century mainly saw the suppression of traditional handicraft knowledge and Taylorism/Fordism was primarily concerned with utilizing the workforce with a minimum of skills necessary. Similarly, one reason why network-like governance patterns develop at societal level is that knowledge has become much more distributed among the various actors than in the past.

Fordism used to be identical with the prevalence of a high degree of division of labor and highly formalized structures. The fact that Fordism became general in the industrialized

countries is also to be seen as a response to the existing specific historical conditions, in particular to mass poverty and the overall low qualification level of the workers. When we compare today's situation with the one in western Europe in the 1920s we are justified to assume that conditions have fundamentally changed: instead of mass poverty there is now frustration due to high tax and social levy burdens, which are a consequence of the welfare state; instead of insufficient qualification there are untapped reserves and sometimes even so-called over-qualification. A new paradigm will also have to take these conditions into consideration, including post-material values which have evolved for some time.

2 What is industrial policy for sustainability?

2.1 What is industrial policy

Industrial policy comprises measures which aim at

- a purposeful change of sectoral industrial structures (reduction of capacities in "old" industries, promotion of "new" industries and of small and medium-sized firms),
- a purposeful change of regional industrial structures,
- at strengthening industrial competitiveness.

Industrial policy is a field which has undergone profound changes in the past few years. The usual patterns of industrial policy in the 1970s—promotion of national champions in high-tech industries, investment guidance, state-owned "strategic industries", financial incentives to encourage industries to settle in peripheral and backward regions—came under heavy fire. Behind this were concerns regarding their compatibility with market mechanisms but also the notion that there were more failures than success stories. There were two types of reactions. Neo-liberals made industrial policy a swearword, radical circles called for an uncompromising abolition of measures which smelled of industrial policy, less radical circles accepted measures which did not discriminate against industrial branches, i.e. were not selective (horizontal industrial policy, "generic" industrial policy). In contrast, pragmatics developed a new understanding of industrial policy—especially there where the dismantling of old industries had assumed considerable dimensions. In essence, there are three new issues: strengthening of industrial locations by means of developing the supporting environment; promotion of new growth industries, especially by encouraging the establishment of new businesses; utilization of new network-like political governance patterns, in which the state does not any longer play the dominant role but societal actors (business associations, trade unions, scientific community, and others) and state together formulate policies.

It is difficult to draw a clear line between industrial policy and other policies. This becomes evident when looking at essential instruments of industrial policy:

- technology promotion

- government procurement policy
- measures related to regional structural policy
- subsidies (tax exemptions, grants)
- infant-industry protection

Consequently, there only few originally industrial policy instruments. Industrial policy overlaps with many other political fields. The most important overlaps exist in the following eight fields:

- **Employment policy.** Industrial policy is not an end in itself. The building of industries and the improvement of their competitiveness aims at creating and safeguarding jobs that are more productive than the ones in other sectors and offer attractive income opportunities. Industrial policy often becomes an instrument of employment policy when a great number of jobs are at risk.
- **Technology policy.** Technology policy has two objectives: to promote the generation of new hardware and know-how as well as their diffusion in economic life. Most technology policy programs thus are part of industrial policy, with the exception of basic research and technology policy related to the agrarian sector.
- **Competition policy.** Competition policy has undergone a twofold change. Instead of perfect competition there is now the notion of working competition, which takes into account that it is the nature of production that there will be only a limited number of suppliers in many branches (in particular because of economies of scale and learning advantages). Yet, the second change in industrial policy is more important: while in the past competition on the domestic market used to be the yardstick it is now global competition—which implies that larger production units are not only tolerated but sometimes even stimulated because political actors assume that only sufficiently large companies are able to survive in global competition.
- **Trade policy.** (1) Friedrich List was the first to give economic reasons for using trade policy in favor of national development policy, he spoke of "Erziehungszölle" (infant industry duties), which the Anglo-Saxon discussion calls infant-industry protection. The point is to seal off the domestic market for a certain time so as to give companies in new branches the opportunity to go through a learning process at the end of which they will be able to compete with already established foreign competitors. (2) Since the 1980s discussion in economics has also focused on trade and industrial development under the heading "strategic trade policy". In this context some economists criticize neoclassical orthodoxy according to which free trade has a welfare-maximizing effect in any case, and they go on to argue that, given selective protection of its industries, a country may gain advantages which cannot be obtained under free trade. (3) Trade policy is an often used pragmatic instrument to reduce the negative side-effects of structural change in industry—in the form of unilaterally imposed restrictions, negotiated quotas (which may be long-term ones, e.g. the Multifibre

Agreement to limit imports of textiles and clothes in industrialized countries) or in form of measures to open up markets.

- **Infrastructure policy:** The overlaps between industrial policy and infrastructure policy have two aspects. On the one hand, the development of an efficient infrastructure is an essential precondition for industrial competitiveness—an inefficient infrastructure (bad/overcrowded roads, lack of railroad and waterway transportation, slow/expensive ports, unreliable/expensive telecommunication and energy supply) easily eliminates the competitive advantages developed within firms. On the other hand, government procurement policy has always been used for industrial policy purposes in the context of infrastructural development. The effects of infrastructure policy for industrial policy become above all evident in the field of energy policy: The option for a centralized system with large-scale power-generating units ruling out competition (e.g. in Germany) brings about quite different incentives for the development of the respective equipment industry than a decentralized, competition-oriented system.
- **Regional policy:** The main target of regional policy used to be to stimulate dynamic economic development of weak regions. The central instrument was the distribution of subsidies to external companies so as to make them invest in such regions, despite their low locational quality. This is a measure that directly (yet not purposively) influences the industrial structure. More recent approaches in regional policy aim at mobilizing endogenous potentials by actively developing competitive advantages, thus they are difficult to distinguish from policies to strengthen industrial locations.
- **Financial sector policy:** Although in most OECD countries the major part of companies' investments is financed internally, policies aimed at the financial sector have a considerable impact on industrial development. The incentives and regulations in the financial sector, which are for the most part shaped politically, determine whether, to what extent and when banks support industrial innovation and restructuring processes.
- **Environmental policy:** Current discussions often give the impression that environmental protection and industrial competitiveness are conflictive goals; more environmental protection, the argument goes, increases costs and reduces the attractiveness of the location concerned. However, the argument may also be the other way round: Stricter environmental policy compels companies to undergo continuous adjustment processes and strive for top performance, thus enhancing their transforming and learning capacities and, in the medium range, their performance. Not to mention that environmental technology industry is seen as particularly promising.

Another point is important: There actually is industrial policy but there is no service policy. In other words, nobody has thought of subsuming all those measures that interfere into the structure of the service sector under a specific term. On the contrary, industrial policy includes quite a few measures that actually aim at the service sector, e.g. in the field of technology policy all measures aiming at the promotion of software companies or technology consultancy institutions, or in the field of infrastructure policy numerous measures related to telecommu-

nication or transport. Consequently, industrial policy is not restricted to those measures that exclusively aim at the secondary sector but also includes measures aiming at the production-oriented service sector.

2.2 General reasons for industrial policy: market failure versus regulatory policies

Industrial policy is the subject of controversial discussions regarding the validity of political intervention in market processes. The advocates of industrial policy maintain that governance exclusively via market mechanisms may make companies behave in a way that is detrimental to the national economy as a whole (market failure). There are various reasons for market failures.

- **Barriers to entry.** They may necessitate interventions by industrial policy if economies of scale in one industry are so high that new, initially small companies are prevented from entry. Economies of scale may exist in research and development, production, and sales. Access barriers may be lowered when firms receive credits or real estate at favorable conditions or when the state guarantees minimal sales through public purchasing policy. Other types of barriers to entry are a case of conventional competition policy, for instance if companies dominating the market fix prices below costs so as to keep newcomers out.
- **Positive external effects.** Innovating companies usually do not have much of a chance to keep information on technological improvements and breakthroughs secret from their competitors. In principle, this is a positive external effect. However, if a company must reckon with the fact that it can appropriate only a part of the benefits of its own innovation efforts, the company will perhaps reduce them. Now, if this becomes general behavior, that is, if companies wait for others to invest in research and development, the totality of R&D expenditure will decrease to a level below the one desirable for national economy of the country concerned.
- **Negative external effects.** Companies are quite clever at making the public pay for certain production costs. Environmental damages are one example, the burning-out of workers due to high performance pressure in companies another. Environmental and labor safety policy are the usual instruments to mitigate this effect. It may be justified to give support to companies that are under more pressure to reduce negative external effects (e.g. as consequence of stricter environmental legislation) than their major competitors in other countries; and countervailing measures in trade policy may be justified if the major competing countries permit their national companies to cause high social costs.
- **Risk and uncertainty.** These are features that are inherent in markets, and the acceptance of risk is a key element of entrepreneurial behavior. There are of course differing types of risks and uncertainties, and state intervention in favor of their reduction may improve the results of the market process. This may apply for instance to very high investments (e.g. very expensive R&D projects) or to situations of technological uncertainty, when the ques-

tion is not which one of the existing options is the best one but when it is unclear what options exist at all.

- **Prisoner's dilemma in structural adjustment.** When crises-ridden industries have to undergo structural adjustment, i.e. when companies have to reduce their production capacities, state intervention into this process may make sense. Interventions in to Japanese process industries in late 70s and early 80s are a positive example in this context. If companies are compelled to adjust to shrinking markets, the individual company will be quite inclined to resort to price cutting so as to force competitors to close down capacities. The ensuing price-cutting race may produce buyers' rents in the short term. There is, however, the risk of stimulating a too chaotic adjustment process, which leads to higher capacity reductions than necessary. Moreover, the companies involved may be weakened in terms of finance to such an extent that their ability to invest in modernization and research and development of new products and processes is impaired so that in the longer run consumers too will have to bear negative consequences.

The opponents of industrial policy maintain that government failures happen as often as market failures and that government failure may produce higher welfare losses. Government failure may result from the following constellations:

- **Limited knowledge of market processes.** There is no obvious reason why a government should be in a better position than companies to assess, for instance, technological developments. Consequently, there is a considerable risk that governmental decisions which technological option to take are wrong.
- **Differing incentives.** As regards companies, market success is the most important criterion. Bureaucrats may follow other incentives too so that their decisions are more influenced by other criteria than by the market criterion and related factors, e.g. the speed of decision-making.
- **Unconditional support or protection.** Government often finds it difficult to fix a clear conditionality for support measures, e.g. performance criteria or time limits. This applies above all to shrinking industries in which a great number of jobs are at risk and in which the political pressure to protect and support companies is high. Companies often rely on their ability to mobilize political support and consider this an easy alternative to adjustment in view of higher competitive pressure. Protection and support measures may thus induce companies not to take sufficient adjustment measures.
- **Selective support or protection.** If a government supports one company or a certain number of companies in one branch only, it distorts market competition at the expense of companies it does not support. As it is difficult, on principle, to fix clear and objective support criteria and as such decisions are often taken under strong political pressure or because of political views of what is most opportune, the companies chosen will often not be the ones that deserve support, i.e. those that have the most promising projects or the best external effects, but rather those that have the best political links.

Both sides use arguments that should be taken seriously. What counts in life, however, is not only (and often not even above all) reasonable arguments, but the ability to mobilize political support. Policy makers are under constant pressure to support crisis-ridden industries in order to safeguard jobs of the people who at the same time are potential voters. The question about industrial policy cannot be answered with a clear yes or no—the real alternative is a strategic, preventive industrial policy versus ad hoc industrial policy in times of acute crises.

2.3 Industrial policy and systemic competitiveness

Another reason for industrial policy stems from the observation that industrial competitiveness often does not evolve automatically, but is rather the result of targeted political intervention. The heuristic concept of systemic competitiveness gives a well-structured idea of what the determining factors of industrial competitiveness are. The latter rests on four pillars (Figure 1):

- the ability of relevant societal actors to formulate and implement strategies at the national and also at regional and local levels (metalevel);
- a solid, reliable economic macropolicy (macrolevel);
- the development of adequate institutions by government, companies and other societal actors to develop or strengthen specific competitive advantages (mesolevel);
- efficient and flexible companies (microlevel).

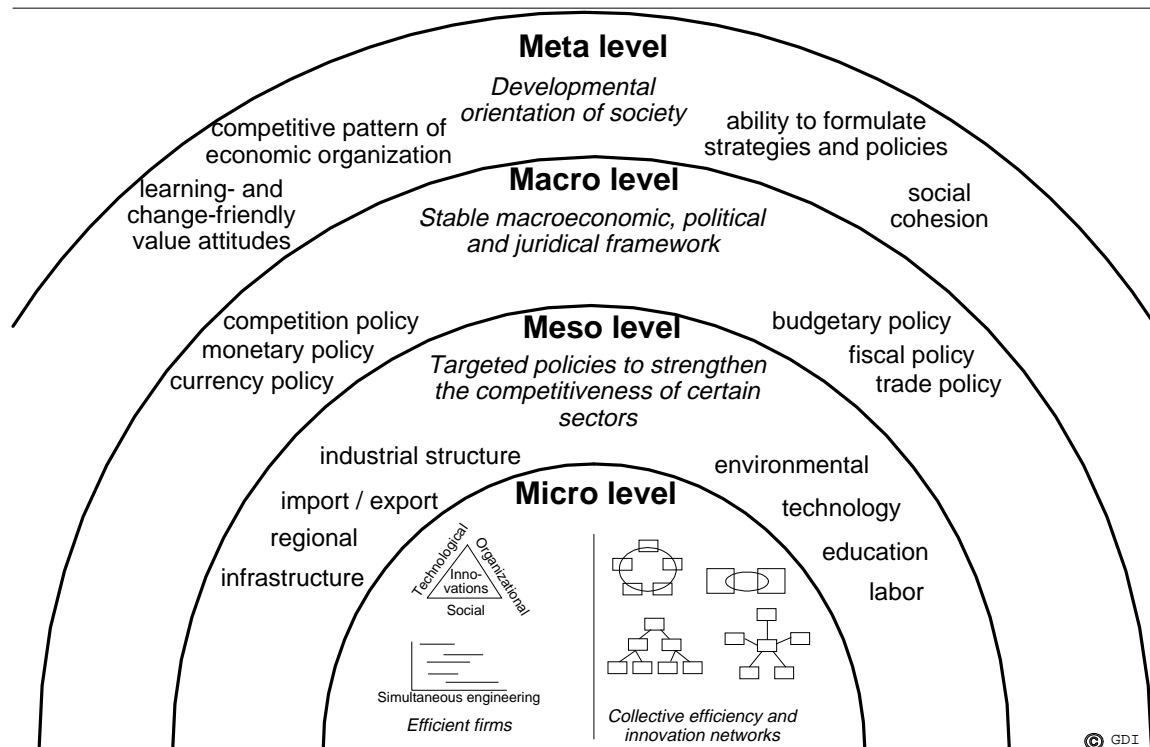
The previously high performance of the German national economy, for instance, rested on its specific strengths at all four levels. The recent locational crisis was due to the fact that former strengths are being questioned and weaknesses become apparent:

- the non-existence of visions and the refusal to formulate strategies at the metalevel, which instead is characterized by sterile fundamentalist discussions on regulatory policies;
- the delay of a number of necessary reforms or their partial implementation only (taxation, social system) and a pro-cyclical macropolicy;
- the undermining of well-functioning institutional arrangements (e.g. regional technology policy) by eroding the financial basis of *Länder* and municipalities, which, in turn, find it increasingly difficult to support companies' efforts for competitiveness;
- problems of companies to adjust to the new competitive pattern.

Insulated measures at the various levels will hardly help to increase the competitiveness of German industry. The key problem is the metalevel that is characterized by short-sighted, often unfinished partial reforms instead of strategy formulation. But what this country needs is a strategy—shared by a broad majority as for instance reconstruction after World War II.

Figure 1

Determinants of Systemic Competitiveness



2.4 Specific reasons for industrial policy: conceptual elements from innovation economics

Why strategic industrial policy makes sense can be explained with the logic of innovation behavior. An unbiased observer will often find it difficult to understand why interesting innovations are not put into practice, be it at company or market levels or at institutional or political levels. Resistance to innovation often seems to be the result of narrow-minded, short-term power interests. A look at the results of innovation economics yet explains why apparent resistance to innovation may be completely rational and economically sensible behavior. In this context, three categories are helpful: the distinction between incremental and radical change, bounded rationality and path dependence.

Incremental and radical technological change. The prevailing innovation pattern in industry as well as in other spheres is that of incremental technological change. In most cases, this kind of change is not spectacular. Processes and products are continuously developed; ever new generations of PCs are a current example of dramatic, yet still incremental technological change. What is really spectacular yet rather seldom is radical technological change, e.g. the

transition from mechanic to electronic clocks or from typewriters to PC word processing. Radical technological change means that an established industry (which produces, for instance, timekeepers) introduces new process and/or product technologies that make a certain amount of the companies' accumulated knowledge obsolete and make it necessary to access a completely new knowledge pool (Freeman 1987). Radical technological change is often accompanied by far-reaching structural upheavals, i.e. new companies enter the market and grow rapidly while established companies are on the decline. The German computer company Nixdorf stands for both the first and, later when PCs were gaining ground, the second phenomenon.

Bounded rationality. Economic actors (managers, engineers, and others) do not behave in a completely but only in a bounded rational way—something which is quite in contrast to the basic tenets of neoclassical economy (Conlisk 1996). In other words, companies do not always optimize their activities in all possible directions nor do they always check all possible options because such a behavior would require far too many efforts at obtaining and processing information. The statement that bounded rationality prevails includes the observation that in reality companies are often not consistent in maximizing profits, but just content themselves with gains they consider acceptable (Herbert Simon introduced the term *satisficing*).

Path dependence. Economic development is path dependent, i.e. once a decision is made at a certain point of time, a specific, technologically defined path of development will still be pursued, even if there are doubts afterwards whether this path is the optimal one (Arthur 1994). The usual layout of typewriter and computer keyboards, for example, is not optimal. There are other layouts which make a markedly higher writing speed possible. But once a huge number of typewriters with a definite layout are in use and typists have been trained accordingly, the costs to switch over to another layout would be high—even if that layout was better (David 1985). The dominating position of the inferior computer operating system DOS and its successors is another example of this phenomenon.

Domination of incremental over radical technological change, bounded rationality and path dependence can be explained with an important observation: innovation is not an event, but a process. The significance of inventions—the proof that something functions—is usually overrated. Inventions (as a result of learning processes concerning their central components) are often "in the air". In the end, it was by chance that the Wright brothers, and not other inventors, built a functioning motor plane at the beginning of the century. To make Wright's airplane a reliable and comfortable means of transport was a far more troublesome and expensive venture than the original construction. These efforts are usually divided among a number of companies whose developments will take several directions until one or two paths of development gain the upper hand. This may be owed to their technological superiority, a higher efficiency, political interests, or accident or a combination of all. Once paths of development have been defined, innovation becomes a cumulative and interactive process—each company will learn from the discoveries and mistakes made by the other companies. Technological learning processes are an example of economies of scale (increasing returns). These processes are the faster the narrower and more precise the path of development has been defined. Definition of a path of development not only means that engineers and technicians have agreed on

what to consider sensible and less sensible technological options, but also includes the establishment of specialized training programs and research and technology institutions, which, in turn, reinforce path dependence (Dosi 1988).

In fact, there are technological and economic as well as micro-political reasons for an apparent resistance to innovation, i.e. resistance to radical technological change. From the technological and economic point of view it is not possible to fix a definite point of time for the introduction of a radical innovation. These innovations are as a rule inferior to tried and tested, mature processes so that an early introduction does not make economic sense. Once a radical innovation has proven its superiority, however, latecomers will find it expensive, if not impossible, to replicate the learning effects of the early movers. From the micro-political point of view the defenders of existing technologies have the better arguments on their side—until the time when it is too late. The implementation of radical innovations is therefore often accompanied by the emergence and rapid growth of new companies on the one hand, and by structural crises and even market exit of established companies on the other. All this explains why it is by no means surprising that a high number of radical innovations was developed but not introduced by European companies, since conditions for the setting up of new companies are less favorable in Europe than in the USA due to the specifics of the financing system (OECD 1994).

Due to path dependence, radical innovations find it difficult to assert themselves. The actors who have agreed implicitly on a particular path of development are usually not inclined to leave it. Radical innovations often win through when two factors are given: first, the development of a new technology which is not only obviously superior but also ready for application at a point of time when even only marginal improvements of established technologies require high expenses, and second, the creation of new enterprises that use the new technology against the established enterprises which are bound to the old technology.

Path dependence causes a long-term determination of technological developments, in particular of large technical systems, e.g. energy supply, telecommunication and transportation. Radical innovations which bring about a complete upheaval of a large technical system are rare. Radical innovations which are obviously so superior that they make alternative development paths possible open a window of opportunity, i.e. a number of actors will try to determine which alternative path to choose. The window of opportunity remains open only for a limited period of time. As soon as a new path of development has been chosen, the principle of path dependence regains its validity and attempts to govern development become more difficult.

The discovery of path dependence and rareness of windows of opportunity is significant as far as governance issues are concerned. The prevailing economic theory holds that the market is the most efficient mechanism for choosing technologies. Yet, due to a series of coincidences it may happen that in the early stage of development a technology is chosen among several alternatives although that technology may turn out to be inferior to the other alternatives (which, however, at this point in time have turned to potential alternatives). As a consequence of path dependence there may be a lock-in, i.e. switching to another, more efficient technology is not realistic in economic terms (Arthur 1994). What speaks in favor of political governance in the

context of a decision on a development path is that more criteria and actors are part of the decision-making process which, consequently, is less prone to coincidence. From the theoretical point of view the market is certainly the superior mechanism in the context of incremental technological change while in the context of radical change political governance may generate economically superior solutions.

2.5 New requirements to industrial policy: sustainability

In view of the global ecological problems a strategically oriented policy must be more than incremental changes of previous policy patterns, i.e. technology policy with a bit more ecology, or fiscal policy with more ecological components (Hinterberger, Luks and Stewen 1996). If the notion is accepted that the current model of production and consumption is not sustainable in the long run and that it must not be transferred to big, still less industrialized countries, the safeguarding of the global future, or sustainability, must become the overruling principle in politics. Sustainability-oriented policies must look ahead: How do we want to live and work in 20 or 30 years?

We find ourselves in a phase in which the old, Fordist paradigm has been exhausted and a new paradigm has not yet been firmly established. Just like Fordism, the new industrial development paradigm will be characterized by a specific interaction of organizational patterns at all four levels of systemic competitiveness. The question is still open which level will be the dominating one. There is no doubt, though, that a new course has been or must be set in a number of areas, which will determine developments in the next decades. Radical technological change plays an important part in this context. Radical innovations in telecommunication, for instance, led to the result that telecommunication is no longer a "natural" monopoly and that a new competitive industrial structure has emerged. This, however, was not only the result of technological innovation, but also of a change of paradigm—at first independent—in politico-economic discussion (the crisis of legitimacy of the interventionist state and the hegemony of neo-liberal argumentation).

In such a situation, technology and industrial policies assume a different significance than in phases with an established path of development and the prevalence of incremental technological change. If there is a stable paradigm it may suffice to rely on the liberal purity, i.e. to create above all the framework necessary for entrepreneurial innovations: competitive pressure and stability at the macrolevel; a differentiated structure of supporting institutions, in particular in the field of R&D and training, at the mesolevel. In this sense it is never wrong, e.g. in the sense of competitiveness of companies, to adopt a strict environmental policy which the uses economic instruments, because this will stimulate innovative processes in companies (Porter and Linde 1995). Such activities are also important and sensible in the present situation. Yet they are not enough because we find ourselves in a phase of changing paradigms.

Nowadays, politics must be targeted at the transition to a new paradigm. This paradigm cannot be worked out from a bureaucratic ivory tower nor in a planning unit. It would not be wise, either, to leave its emergence to the anarchy of the market and to resort to political measures

only afterwards—when the paradigm has been defined in essence—to repair the damage. What matters now is that the key actors come to understand what is on the agenda—not political day-to-day management, but the setting of a new course. Important decisions which are made now may consolidate or block paths of development in the long term. Path dependence is a category which does not exist in the prevailing economic discourse. This explains why the majority of economists recommend to abstain from political governance. Yet, governing a change of paradigm is not only indispensable in terms of social sciences but can also be rational in economic terms.

The present situation should be understood as an open search process. Ad hoc measures and crisis management, which determine current politics, are not adequate. What is needed instead is the organization of search processes by and throughout the society. Let us have a look at an example, namely communication infrastructure. No doubt, this area undergoes a radical change. There is no clear distinction between individual and mass communication any longer and telecommunication and data processing become more and more interwoven. In other words, a new path of development is emerging. It has been shaped in a way that is not appropriate for a democratic society: there is a dialogue between the scientific community and companies, with occasional involvement of the executive but almost no participation of the legislative and the people actually concerned. The people, or the citizen, has only a small part to play in this process, i.e. as participant in field tests. This, however, is not participation because when a technology is tested in the field the most important parameters have already been decided on.

Such a procedure is not only unacceptable in democratic terms, but also counterproductive in economic terms. Those actors who invent and develop the new communication infrastructures are certain to follow a given path of development, i.e. they will rather tend to incremental than to radical innovations or be quite reluctant to use them (e.g. a radically new technology applied within the framework of old organizational patterns). Thus, creativity potentials are wasted which could be used if such actors were involved early on whose thinking patterns with regard to communication infrastructure are still flexible, e.g. people like you and me. This amounts to the utilization of instruments like consensus conferences (TAB 1996) or future workshops (*Zukunftswerkstätten*, Jungk and Müllert 1989) which are designed to go beyond today's path dependence and think about future paths of development. Such procedures may provide the orientation for the further development of technologies. There are enough inventions, and the point now is to identify those the development of which is desirable for society.

Participatory processes for the definition of sustainable trajectories of development in comprehensive technological systems like information and communication will have to take place at the level of society as a whole. Nevertheless, it is not only sensible but also necessary to think about long-term development and sustainability at the regional and local levels.

3 Levels of action of an industrial policy for sustainability

3.1 Sustainability in the context of regional and local development concepts

Globalization and localization are complementary processes. If companies want to operate throughout the world and be competitive on world markets they need a well-developed environment which is often local. This leads to new requirements for locational policies at the local and regional levels, i.e. to collective efforts aimed at improving the companies' environment. A number of state actors as well as companies and their associations, trade unions, scientists and other actors play a part in this context. The pressure for action often stems from closures or migration of companies, stagnation in many companies and growing unemployment.

Consequently, many regions are not just faced with the chance but with the necessity to formulate local or regional development strategies (e.g. Bäumer 1996, Wallis 1996). Such a strategy should be more than a program which just suggests all sorts of project for locational improvements for one year and a half or so. Strategy formulation should follow the East Asian example, i.e. it should answer the questions what the development of the region should be like in the next 20 years and how to achieve this.

This approach differs from the one recently applied in Germany. What is prevailing is a pattern which is characterized by less "stick" and more "carrots": the pressure on companies is reduced—fewer taxes, lower wages, less environmental protection and in addition the nice effects of the devaluation of the Mark. If supply-driven innovation policy (expansion or reorganization of universities, technical colleges, research institutes, or new business centers) dominates in such a context, the results can only be limited. In other words, i.e. following the logic of systemic competitiveness: if the situation at the meta-, macro- and microlevel is dissatisfying, actionism at the mesolevel will not be successful. Serious innovation policy must try to be aware of all levels and their interactions among each other. The metalevel will be of particular significance, i.e. the relevant actors should reach agreement on the approximate direction that development should take.

There is hardly an alternative to sustainable development when it comes to long-term strategies. The final document of the Rio conference of 1992, which Germany also signed, Agenda 21 with its triple aim of ecological, social and economic development offers a guideline for local strategy formulation: Nobody wants to imagine that the way of life and economy might be more resource-intensive and dirtier 20 years from now. The social problems stemming from poverty and unemployment manifest themselves in particular at the local level and produce pressure to take action, and the significance of a solid economic basis is clear above all to actors from regions where the very basis is being eroded.

A local Agenda 21 does not necessarily mean that the conflicts between ecology and economy continue to intensify, on the contrary, it may show a way out of the conflict. It goes without saying that this is not a simple process—the current polarization between the demands of

companies for cost reduction and deregulation on the one hand and slogans like "competition stimulates business—and destroys the bases of life" (BUND Berlin 1996, 17) on the other, cannot be overlooked. A local Agenda 21 as a process of strategy formulation requires far-reaching learning and adaptation processes from all sides involved: companies must overcome their path dependence and state actors their bureaucratic routine and internal arguing, NGOs must revise their traditional thinking and argumentation patterns. The relevant actors must carry on a joint search for an answer to the following question: *What is the sustainable economic structure of the future that we are striving for, i.e. which are the sectors which create jobs that produce products and services with a significantly lower resource intensity (with regard to both process and product)?*

It would be presumptuous to try to give a correct answer here. Moreover, it would run counter to the very principle that should be the basis for the process of strategy formulation. The principle is: there is an open and unbiased search process, in which a broad spectrum of relevant actors gather, discuss and define the priorities of ideas and concepts for a sustainable development strategy. Instruments to be used in this process abound (*Metaplan* and other planning techniques, professionally moderated workshops, etc.), although they may not be sufficiently known and meet with resistance or even fears among some actors. The next step is that various actors start implementation in their respective areas. If local transport, for example, were identified as a promising area of action which has priority, and an alternative and less resource-intensive transport system were outlined, the state would have to take corresponding measures in the field of traffic policy, educational institutions would seek to disseminate a new concept of transport, companies would begin to develop innovative products for the new system, etc. This process, which would last for years, would correspond to the establishment of a new trajectory of technological and organizational development. It needs a feedback in the form of forums for information and communication so that even when the trajectory is narrowing differing interests are taken into consideration and other views and ideas may be added. The result might be a regional cluster of innovative manufacturing and service companies, which can market their products in those regions, too, where reorientation towards sustainability began later. In other words, the orientation towards sustainability may initiate an innovation process that can lay the foundations for a dynamic economic development in the pioneering regions.

3.2 National level

The function of the national level with regard to the formulation of new industrial policy is redefined to the extent that company-related activities of locational policy are decentralized. The traditional instruments of industrial and technology policy, e.g. demonstration centers, technology centers, and promotion of networking, are more and more used at the level of the *Länder* and below. As far as sustainability is concerned industrial policy at national level will have to focus on three areas:

- the transition from conventional, rather inefficient environmental policy, which uses above all command and control instruments, towards the utilization of economic instruments and material flow management (industrial metabolism). Economic instruments as pollution certificates are more efficient, because emissions will then be reduced there where costs are lowest in relative terms. Instruments like environmental management and eco-audits make the simultaneous achievement of economic and ecological advantages possible at company level. Material flow management (Hinterberger, Luks and Stewen 1996) is a concept that helps to achieve a better comparison of ecological damages which are produced by competing products and is thus the basis for ecological awareness and corresponding consumer behavior.
- reorientation of economic macropolicy towards sustainability. An ecological tax reform is the central element here and provides incentives for a considerable reduction of energy intensity in production and consumption.
- stimulation and support of an innovation policy geared to sustainability. The point is to find new ways above all in such sectors where radical changes occur. In case of radical changes technological and organizational changes mutually reinforce each other. Examples can be found in the energy sector, in long-distance traffic, and in transmission and processing of information. As regards the energy sector and long-distance traffic, changes of industrial organization are prevailing. What is significant here is above all the process of deregulation, which causes the introduction of fierce competition in markets which used to have monopolistic or oligopolistic organizational patterns. A new configuration emerges which—due to path dependence—will determine development for decades to come. This configuration is not necessarily compatible with sustainability; experience made so far rather shows contrary effects. An example is the deregulated market of air traffic, which is the least environmentally friendly form of long-distance traffic, but manages to increase its share in the transport market. Another example is the deregulated energy market in which energy prices for bulk buyers decline and, consequently, a growth of energy intensity is probable. Trends are less clear in the field of information transmission and processing. Political interference is necessary here, too, one reason being the utilization of potentials that are inherent in the substitution of physical transport by telework.

3.3 Supranational level

The EU member countries and the EU Commission began to reorganize the division of responsibilities in the field of industrial and technology policy in the 1980s. The Commission took over certain responsibilities, in particular programs related to technology policy, e.g. Esprit. In this sphere there was little resistance on part of the member countries owing to the weak international position of the European electronic industry. On the other hand, the Commission was also formally granted several areas of authority under the European Act, above all in competition policy and supervision of financial assistance. In the context of sustainability three aspects are significant:

- Reformulation of the industrial and technology policy of the EU. The 1993 White Paper "Growth, competitiveness, employment" was a first attempt to correlate competitiveness with sustainability.
- Uniformity in ecological norms in the EU. Some EU member countries, in particular in Scandinavia, have found eco-taxes quite satisfactory. It is no longer true that a "prisoner dilemma" hinders ecological progress in the Union. The point is to disseminate positive experience and to look for allies, above all in large countries.
- Joint positions in international negotiations (e.g. CSD). The EU should act more consistently, emphasize its success and present itself as a credible example for other countries, i.e. by referring to plausible efforts. Since the USA rather act as a brake now, the European Union has the chance to distinguish itself in this field—not only in environmental and climatic policies in the narrower sense, but also, and in particular, in the intra-capitalistic "competition of systems"; in contrast to the "American way of life" Europe might present itself as a model characterized by ecological awareness, less Darwinism and less violence.

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