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Do We Need a Strategic High Technology Policy?

Germany, with the rest of Western Europe, is in danger of losing the race to Japan for the lead in the field of the new key technologies. What is the reason for this? Do we need a strategic high technology policy? The following three articles present differing answers to these questions.

Konrad Seitz*

The Case for a Federal Government High Technology Policy

We are now in the midst of a second industrial revolution, which is being driven forward by five new key technologies, namely information technology, genetic technology, new materials technology, new energy technology and space technology. Yet Germany and Europe are not keeping pace with this revolution. Indeed, the biotechnological industry, which is destined to be one of the world's great industries by the early 21st century, has not even been established in Germany. The semiconductor, computer and consumer electronics industries are not very highly developed, and face the threat of decline; it is uncertain whether it will be possible to save the machine tool and telecommunications industries should those other industries be lost. Do we therefore face the prospect of Europe going into decline just as China and India did when they failed to keep up with the first industrial revolution at the beginning of the 19th century?

Our economists do not appear to share these worries in the least. "If so, we shall just have to produce something else," was the response given by a leading representative of the Kiel School to warnings that Germany was well on the way towards losing its information technology industry.

The Ministry of Economics also reacted in the same vein to a French memorandum demonstrating the rapidly accelerating decay of Europe's electronics industry and calling for EC measures to counteract that trend. The responding memorandum stated rather tersely: "The principle of the international division of labour as determined by comparative cost advantage applies to all fields of production, and high-technology products are no exception."

According to our prevailing economic policy creed, what the economy produces and what industries it contains ought to be determined by the market alone. Government bodies are called upon to confine their activities to creating the right conditions for competition, and hence the market, to function properly. This maxim did indeed serve us well during the Erhard era, and we owe West Germany's economic miracle to those principles. Nevertheless, it has now become quite imperative to face up to the issue of whether the maxims of the 1950s and '60s really can be applied to the present day, which is so very different in character.

The two statements of economic policy quoted above are based on two assumptions:

- ☐ Firstly, that all industries are equal, i. e. DM 100-worth of potato chips = DM 100-worth of computer chips,
- ☐ and secondly, that every country produces and

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exchanges the goods in the production of which it has a comparative advantage relative to its trading partners.

The upshot of this in practical terms is that if Europe's comparative advantage happens to lie in producing potato chips that is exactly what it ought to do, exchanging them for computer chips from Japan. The theory states that both parties benefit from this division of labour, and that both score welfare gains.

The economic logic of the above is flawless – provided that one is not thinking about the future. The problems begin, however, the moment one asks which of these economies has the better prospects for the future – the potato chip economy or the computer chip economy?

Classical theory is a static theory. But we are living in an industrial revolution. What is therefore needed is a Schumpeterian, dynamic approach. The static fundamental assumptions underlying our economic policy – the idea that all industries are of equal value coupled with the theory of comparative advantage – simply do not relate to the crucial realities of today's world economy, i. e. neither to the new reality of high-tech industries nor to the reality of Japan.

In the Erhard era, the belief in the equality of value of all industries was not harmful, and indeed was of benefit to us. At that time, we were concerned with the industries of the first industrial revolution, in which Germany occupied a leading position; at that time, the market did indeed automatically regulate everything in our favour. Yet now that the second industrial revolution is upon us, this belief represents a lethal threat to our future. For the micro-electronics, computer and other high-tech industries which our classical economists are so graciously willing to abandon in order "to produce something else" are not only the growth industries of the present day and the source of highly qualified, and hence well paid, jobs. They are also the strategic industries which simultaneously determine how competitive the "old" industries and services can continue to be. Any economy which forfeits its competence in these areas will become one-sidedly dependent on the supply of key components from abroad, and will increasingly tend to lose the ability to develop new equipment and plant at all.

An Old Theory

The theory of comparative advantage, in the name of which the Ministry of Economics is prepared to leave Europe's electronics industry to its fate, equally belongs to a different age.

The theory was originally developed by Ricardo at the beginning of the 19th century, and is based on the

observation that different countries are endowed with different natural resources. Every country therefore has an advantage – at least in relative, if not in absolute terms – in producing those goods for which its natural resources make it most suitable: thus Britain traditionally traded wool for Portuguese wine. Early this century, the theory was expanded upon with the aid of the concept of differing "factor endowments", i. e. endowment with the factors of production of land, capital and labour. This was then able to explain why India, which was richly endowed with cheap labour, exported labour-intensive products such as textiles while it imported capital-intensive products such as machinery from Europe and America which were capital-rich.

What this theory explains is a complementary, *inter*-industrial pattern of trade. However, since the second world war a constantly increasing portion of world trade has consisted of *intra*-industrial trade, with automobiles being exchanged for other automobiles, computers for other computers, and so on. Yet such trade cannot be explained in terms of any pre-existing advantage.

Where classical theory really becomes truly irrelevant is in explaining trade in new, high-tech products. The fact that Japan today dominates the markets for memory circuits and LCD displays, or that the Americans are dominant in microprocessors and computers, whereas Europe plays virtually no major part in any of these areas, has nothing to do with differences in factor endowments. In principle, the availability of capital and of qualified labour (researchers, engineers, specialists) is similar in all three regions. This is a field in which a different law operates, namely the law of "first mover advantages", which states that whichever economy is first to establish a new high-technology industry will also be the one which can keep it. In the high-tech age, "comparative advantage" is no longer given, but a parameter which itself has to be produced. Thus, once a certain party has established an advantage it is almost impossible for it to be taken away again.

The last point is a crucial one. It can be explained by the fact that the new, large-scale technologies of the age of information such as super-integrated chips, liquid-crystal displays, telephone exchange systems, super computers, etc. have a number of unconventional economic characteristics which render the classical perfect competition model inapplicable:

□ To begin with, there is the factor of the high level of *fixed costs*, covering research and development, production plant construction and so on, which frequently run into billions. Huge production runs are then necessary to amortize those costs. Thus the markets in these new,

large-scale technologies only leave room for a small number of suppliers – they have an oligopolistic structure.

□ A second factor are the *increasing returns to scale*: the larger the volume produced, the lower the unit costs will be. Whereas the optimum plant size tended to be attained at a relatively early stage in conventional industries, with returns to scale beginning to decline again after that point, the production curve has a different shape in the new, large-scale high-tech areas, continuing on an upward path to very high production levels. Boeing has a share of 60% of the world market in large passenger aircraft, yet it still has not exhausted all its potential increasing returns to scale. There are two main reasons for this effect. The first of these are the high fixed costs which translate into lower unit costs the larger the number of units produced. The second, more important factor is the learning-curve effect: the more semiconductor chips a company produces, the better it will learn to master the complex production processes involved, and the less wastage will be generated.

□ Thirdly, industrial *standards* also play an important part: When IBM chose an Intel microprocessor for its Personal Computer, this became a worldwide standard and Intel, with its patent rights, was placed in a monopoly position.

□ Finally, there are regional *networking and feedback effects*. The area in which chip manufacturers have developed best is naturally also likely to be the area where their suppliers develop best. Japan's microchip factories are indeed therefore surrounded by a whole collection of different supplier industries: manufacturers of highly purified silicon, fine chemicals and clean room technology, of production and testing equipment for the microchips, ceramic housings for chips, and so on. Japan is the only country today with a comprehensive chain of input producers for chip factories, and experts predict that as early as the chip generation after next, when they will have become extremely highly integrated, Japan will be the only country able to produce them at all.

All of these new characteristics have the same basic implication: the barriers to entry into high-tech industries are incomparably higher than in conventional industries. Once a company is established in the market, it can benefit from increasing returns to scale and can further strengthen its position. Those which arrive too late will hardly have any chance of penetrating the market. There are only two exceptions to this rule: either the newcomer is able to apply a new technology to effectively wipe out the established producer's accumulated advantages, or else it can draw upon an adequate level of government assistance. Two

examples of the latter are the Japanese microchip industry and the European airbus consortium.

The Separation of Value Added

The opinion widely held by classical economists, that it is unimportant to whom a factory in Europe belongs – to Europeans or to the Japanese – is, finally, also evidence of their lack of understanding of the new economic characteristics of advanced technologies. Let us examine this opinion with regard to the semiconductor industry and assume that in the year 200 *all* the chip factories in Europe are branches of Japanese chip producers. What would this mean for the Europeans?

□ To begin with: The development of the new generations of memory chips would then take place exclusively in Japan. The first major item of value added would thus fall exclusively to the Japanese. Already today the cost of the development of the 64-megabit chip lies at one billion D-mark and the development costs for coming generations will be much higher.

□ The newly developed chip then goes into production – in Japan, of course. The Japanese profit from the high initial prices. After a certain time – prices having fallen – production will be begun in the European factories. The equipment for manufacturing and testing comes from Japan, as does the clean room technology.

In this way, the second major item of value added also falls to the Japanese. The production line for the 64-megabit chip will cost up to two billion D-marks and, here as well, the costs for future chip generations will be much higher.

□ So what is left for the Europeans? They provide the workers on the production lines, the middle management and the sales personnel. These are all activities with a relatively low value added and that means: with relatively low wages.

What is true for semiconductors is also true for main-frame computers, telephone exchange systems, high-definition televisions etc. In contrast to the technologies of the first industrial revolution, in the case of high technologies the activities with a high value added can be separated from those with a low value added. The former remain in Japan; the latter are left to the technological colony.

This leads us to the second new and important reality in the present world economy: *Japan*. In the triad of highly developed regions: America – Western Europe – Japan, there exists not *one* type of market economy, but three:

□ the capitalist market economy of America,

- The socially orientated market economy of Germany,
- the future-orientated market economy of Japan.

The Japanese form of market economy is obviously superior to both the American and the German system.

When Japan rebuilt its economy following the second world war it sealed off its own economy from imports as well as from foreign investment and, from the end of the sixties onward, directed its economy into the strategic technologies of the future by means of an unerring industrial policy. Japan then went over to exporting on a large scale in the seventies. The protected and highly profitable home market subsidized the dumping attacks with which the Japanese conquered the world market. Japan introduced a new type of trade into the free trade world of the GATT, a type of trade for which Peter Drucker¹ coined the phrase "adversarial trade". This is a trade which aims not only at participation in world trade but at its conquest – a trade which destroys the industries of the trading partner.

Japan then began from the mid-seventies onward to reduce its barriers to trade and investment to the extent to which its own industry gained in competitiveness. Today, Japan is the country with the lowest customs barriers and the fewest import quotas. But then it became apparent that formal barriers were no longer necessary to keep imports and foreign direct investments out. The structural barriers of the Japanese economy and culture now took effect: the system of horizontal and vertical industrial groups (*keiretsu*), the system of sales outlets under the control of industry, the exorbitant property prices and Japan's closed society.

The Japanese market continues to be largely closed for goods which are also produced in Japan. This is particularly the case for high-tech goods. For example, in 1987 the Japanese market for know-how-based products was to 94% in the hands of Japanese firms; only 6% of these goods were imported, and the greater part of this 6% consisted of large passenger aircraft, which Japan does not (yet) produce itself. Japanese high-tech firms thus continue to have their home market to themselves and can amortize the development costs in that market: the prices for electronic goods are up to 60% higher in Tokyo than the prices of the same Japanese goods in New York.

Operating from the profit basis of their home market the Japanese firms conquer the American and European markets via price campaigns and monopolize the strategic key technologies world-wide. These monopolistic

strategies cannot be countered by helpless evocations of the principle of free trade. And they also cannot be countered by filing dumping complaints with the GATT: GATT procedures are drawn-out and when the decision is finally arrived at, the industry it was desired to protect will have already perished under the Japanese attack.

Classical trade theory answers the problem of one-sided protectionism, by the way, with the statement that free trade even brings advantages to the free-trading partner if the other partner protects his industry. The new trade theory, on the other hand, shows that in the case of strategic industries protectionism on both sides means the worst result for welfare as a whole but that each of the partners is still better off than if he alone behaved according to the rules of free trade.² The solution therefore cannot be to capitulate unilaterally and leave the field to Japan.

What is to be Done?

So much for the new realities and theories. They demonstrate clearly that for the field of high technology the axioms on which German economic and trade policy are based have lost touch with reality. On the other hand, they do not provide any concrete prescriptions as to what form an economic or trade policy for the field of high technology ought to take. A great deal of thought is still necessary here – new and at the same time careful thought which is aware of the complexity of the problems.

The following basic conclusions can, however, already be drawn at present:

- As much as the role of private enterprise continues to have priority, the development of high technology industries nevertheless demands *cooperation between the state and industry*. The reconstruction and securing of global competitiveness in the new high technologies must be declared a central task of, among others, the German federal government, which must then, together with the French government, at the same time take on the leadership for such a policy in the EC.
- An *overall strategy* is necessary. It must begin by identifying the strengths and weaknesses of our economy and must use the strengths in an optimal way while overcoming the weaknesses where they endanger our future. Isolated, individual projects, undertaken ad hoc, are bound to fail. An overall strategy also means that individual policy areas must be brought together and

¹ Peter Drucker: *The New Realities*, Heinemann Professional Publishing, Oxford 1989, p. 122 f.

² Cf. J. A. Brender: *Rationales for Strategic Trade and Industrial Policy*, in: Paul R. Krugman (ed.): *Strategic Trade Policy and the New International Economics*, The MIT Press, Cambridge, Massachusetts 1986, p. 36 ff. On the new trade theory cf. also Paul R. Krugman: *Rethinking International Trade*, The MIT Press, Cambridge, Massachusetts 1990.

coordinated – from educational policy through infrastructural policy, tax and economic policy to trade policy.

□ Within the framework of this overall strategy an *industrial policy* is necessary, and that means: we must complement our fundamental and determined adherence to competition and free trade with the selective promotion of the identified strategic industries. We already make exceptions from the market economy principle, but these are applied, under the pressure of political lobbies, to conventional industries such as coal and shipyards. We must make the exceptions instead for the industries of the future; instead of being economically irrational the exceptions must in future be rational.

□ Hand in hand with industrial policy there must be a bilateral (German and European) *foreign trade policy with regard to Japan*. Whereas the European market is open to exports from, and direct investment by, Japanese high-tech enterprises, the Japanese market is de facto largely closed to European high-tech enterprises. The task of foreign trade policy is to make it possible for European companies to establish positions in the Japanese market

by means of strategic cooperation with Japanese firms. Industrial policy must make European businesses capable of cooperation and trade policy must politely but firmly see to it that Japanese businesses, with some “persuasion” from MITI, are willing to open up the market by cooperating in this way. If, for example, Motorola develops and produces automobile chips for Toyota, then it should be possible for Siemens to do the same for Nissan.

□ At present the German federal government does not possess any institution which would be capable of working out an integral concept for the global self-assertion of the German economy in the age of high technology. The first step could be the setting-up of a “*Committee of Experts for Strategic Competitive and Trade Policy*”. The Committee should be established by the Federal Chancellor or by the Chancellor and the Bundestag. It should consist of about twelve representatives of industry, the government, the trade unions and the academic community who should be chosen on the basis of their personal qualifications for the task in hand. The American “Competitiveness Policy Council” set up in 1991 can serve as a model; it has just presented its first report to the President and Congress.

Michael Glos*

Do We Need a Strategic Industrial Policy à la MITI?

The continuing success of Japanese companies on world markets has been a subject of growing interest in corporate, academic and government circles. In the 1980s the Japanese economy showed a real-term growth rate of more than 4%, almost twice the rate of economic growth in the other leading industrial nations. Japan's automobile manufacturers are vastly superior to their international competitors in terms of productivity and quality. The Japanese have revolutionized production techniques (we need only think of the term “lean production”). In connection with major technology areas such as superconductors and image processing Japan has largely taken over the lead from the United States.

Some “visionists” are even saying that by the 21st century Japan will have advanced to the status of a superpower whose influence will not be based on military strength, but rather on its technological lead and the economic power of its industrial companies, its trading firms and its banks.

There is a tendency to seek the reasons for Japan's success in the role played by government in the Japanese economic process. To the outsider, government and industry in Japan appear as a single unit (“Japan Incorporated”), in which a special role is attributed to the Ministry of Trade and Industry (MITI) in connection with the coordination of activities between the public and the corporate sectors. Industrial development is supported and “guided” by a forward-looking industrial and research policy. This integrated economic policy – as it were –

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