Europe Panel

Research

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CHAIRMAN PERKINS: We begin our European Panel with Dr. Alain Bienayme, a member of my own ICED Board of Trustees. He is a distinguished Professor of Economics at the University of Paris-Dauphine and in addition has been an advisor to almost every recent government in France. Dr. Bienayme has chaired many important public commissions concerned with education.

DR. BIENAYME: Thank you, Mr. Chairman. My comments here will amplify upon my written article, "The University and the Corporation: Their Cooperation in Research in Western Europe" which focuses on the West European collaboration between industry and universities and research and development issues. *[The article follows this commentary.]* Let me first state that this cooperation may involve diverse kinds of activities such as joint research, exchange of personnel and exchange of information, consulting and auditing in technology, research grants, material equipment, gifts or lending and, of course, mutual participation in boards and scientific committees.

We should add to this list patent agreements, post graduate training, new ventures created by graduates and so on. In most European countries, although universities are still very active in research and play a predominant role in basic research, higher education has lost its former monopoly in research, if it ever had one.

The concept of R&D which was coined in the late 1950s expresses the view that activities of R&D have spread well over the walls of universities to public and private laboratories which are more tightly linked to the production sector. Higher education has thus become in Europe a subset of a complicated

network which includes not only competing institutions but also would-be partners who are not directly dedicated to the end-users' needs, neither to full-time professionalized research, or to economic performances and market profitability. Thus, the Max Planck Institute in Germany, for example, or the C.N.R.S. in France and the research laboratories, I.N.S.E.I. of big companies are today important employers for young researchers who were trained at universities. This situation has been influenced by new trends which affect European industrial revival.

The first trend is the important role played by technology in international competition, a fact which Western Europe has recognized a little later than Japan and the United States. A second trend is that the big corporations, unable to master alone each of the 15 to 20 new technologies, are forced to combine efforts in order to produce satellites, sky rockets, arms system or complicated industrial products. R&D is both costly and risky -- these costs and risks have to be shared by corporations through joint ventures.

The third trend I see is that today universities are being discovered in many European countries as a worthwhile source to tap in order to enrich the cooperation between European companies. The final trend is the growing recognition that technology is not a cure-all. Many business companies in Europe, although they are technologically sophisticated, fail in their economic performance because the technological dimension had not been properly integrated in a global strategy, a search for global opportunities and global markets.

With this background in mind, Western Europe has become aware that most of its nations are lagging a little behind the United States and Japan as far as R&D is concerned. Germany and Sweden are the only countries in Europe who devote more than 2.5% of their Gross Domestic Product (GDP) to R&D. Other countries such as France lie further behind. Some countries such as Spain and Greece, for example, are doing very little research.

The proportion of scientists in the labor force in Europe is also well under the figures we have for Japan and the United States. Again, excepting Germany, European industry funds a lower percentage of the total R&D spending. This means that the public authorities have a great weight in R&D

allocations.

Finally, to complete the background of the European picture, I must add that we suffer still from a strong market fragmentation and from wide differences in public regulations. These two facts, market fragmentation and public fragmentation, have hindered up to now the development of a genuine European partnership in industrial R&D.

So, until recently, most of the European experience in industry-university cooperation in research comes from nationalistic origins. In my accompanying paper, I show the wide variation between countries where collaboration is traditionally tight and widespread. The most outstanding examples are Switzerland and then Germany. They offer a contrast to countries like the United Kingdom and France where university and companies have been existing in two totally different worlds. I would also like to mention countries such as Spain or Greece where research is still modest and countries such as Denmark where new research structures appeared as recently as only two decades ago. New technological institutes in Denmark have had a very receptive welcome from the entrepreneurial class.

The West European experience reveals that two parameters seem very decisive in the content, the quality and the intensity of collaboration between businesses and university -- namely, the size of the corporation and the maturity of industry. My paper stresses also the fact that the research assets of universities can or should be mobilized to serve the interests of regional development as is demonstrated in the Scandinavian countries and France.

For example, in the less developed areas of France, the small and medium size businesses acting in traditional activities are valuable but difficult to approach. In fact, they are more difficult to approach than the big corporations and the small high-tech ventures. However, experience shows that specific liaison offices or linking agencies offer very valuable help so as to generate within these small traditional business some kind of appetite to modernize their technology with the help of universities and the technological institutes.

So it appears that technological diffusion is a very important component of the whole problem of collaboration on research between universities and

companies. Collaboration between universities and corporations appears thus as a *must* in order to help business companies to survive in competition. Cooperation, however, is by no means a natural and spontaneous trend. It is viewed very often as a second best solution by business companies who hope to keep their autonomy and their own strategy.

Cooperation with traditional universities is a source of friction due to the lack of a common culture with common values between the researchers and the business community. According to a recent research study conducted in Belgium, scientific researchers who are most appreciated by corporate staffs of successful companies have to be both excellent in their scientific achievements and careers as well as deeply interested in the business strategy in which they play a key role. A researcher coming from the academic community who is in charge of a research project within a business company has to comply with this implicit rule.

There is a traditional view that European universities are not considered as major actors in technological progress nor a valuable partner for a corporation. This traditional view, I may say, is, however, not equally shared in all European countries or in all their regions and for a few decades it has by no means been an appropriate view.

According to another recent and more simplistic opinion, university-business cooperation is a kind of cure-all. The simplicity of this opinion is illustrated by the example of Switzerland. The excellent network in Switzerland which has strongly enhanced the nation's socio-technic culture in pharmaceutics, chemicals and mechanical engineering has not prevented the watchmakers' industry to be ousted for a time by Japanese industry. University and business cooperation needs to be completed with a good strategic capacity.

If the collaboration between university and corporation is not a natural situation, then it has to be encouraged. In Europe, the states have created agencies and are devising incentives in order to help these two partners to cooperate. However, according to a recent inquiry made in France appraising the quality of the public support to R&D, the French industrialists show some skepticism concerning the quality of research supplied by the public sector and

the universities. They think that it has been of little relevance to their competitiveness and to the future of French industry. Nevertheless, as revealed in many polls and sample inquiries, they ask for more support from the state.

The future of European countries in this matter as in many other now lies in the progress of European unity. And here we must be aware that new major trends are underway. We are now entering into a period of European industrial revival and in the next few years there will be a mushrooming of initiatives in which business companies, universities and public labs will develop their links. This is already the case in some scientific ventures in information technology (program E.S.P.R.I.T.), manufacturing technologies and telecommunications. These programs show a significant involvement of universities.

In a program like EUREKA, which runs more than two hundred projects, universities are less involved because EUREKA's projects are closer to market applications. However, the growing trend is for universities to play a larger role with business. In this capacity, I should also mention a new program in continuing education for high-skill engineers who want to refresh their knowledge in the most advanced scientific discoveries and technologies. This satellite delivered program is called PACE.

I would like to conclude with three final remarks. First, R&D involves not only the activity of producing novelties. R&D efficiency requires diffusion and continuing education in which higher education has a significant role. My second remark stems from the experience of France and European countries. Cooperation implies a new state of mind from the researchers' community. They have to accept the challenge to take a genuine interest in business strategies, in what I could call the business poetry. After all, businesses are creating new things, new systems, new ways of approaching reality. The research staff also have to accept some kind of mobility.

My third and last remark is that in the European multilingual and multicultural context, the next generation of graduates and postdoctorates will find new job opportunities and new patterns of careers thanks to the impetus given by the international competition and cooperation between countries in technology.

Thank you.

CHAIRMAN PERKINS: Thank you, Dr. Bienayme, for an excellent presentation. I was very pleased that you brought in some experiences of countries other than France so that your report was on the entire European situation.

(Included here is the full text of the article which Dr. Bienayme referred to in his conference presentation.)

THE UNIVERSITY AND THE CORPORATION:
Their Cooperation in Research in Western Europe

by

Alain Bienayme

"The fog which separates knowledge
and enterprise should break up.
Enterprise is knowledge at work."
Edgar Faure

Business corporations and universities of industrialized countries are experiencing **four major trends** which give impetus to their cooperation in research activities:

1) The role of technological progress has greatly increased in international competition. Western Europe, Japan and North America which account for 20% of the world population, produce and consume 80% of high technology products. [1]

2) Most manufactured products and a growing proportion of services are using a high number of different technologies which are costly and difficult to master alone even for a large company. Research ability and engineer training are therefore at the edge of international competition because they have become rare and valuable assets.

3) Universities which provide most of the engineers and scientists on the one hand, and graduate a significant proportion of managers on the other hand, are experiencing financial difficulties for a host of well known reasons. [2] Cooperation between universities and business is both a way to alleviate the shortage of funds of universities as well as to enhance usefulness and relevance of research by strengthening the participation of end-users.

4) The aptitude to master technical progress is strengthening the

business company's ability to resist and to promote industrial competition only to the extent that its leaders are able to develop a vision of their global markets and global opportunities as well as a capacity to insert R&D into a global strategy. [3]

Within this context, Western Europe shows **specific features** which can be summarized as follows:

1) The weight of European R&D is lighter than in Japan and U.S. In 1987 the U.S. devoted more than 100 billion dollars or 2.6% of their Gross Domestic Product (GDP) to R&D; Japan spent nearly 40 billion dollars (2.9% of their GDP). The four major EEC countries follow with 19 billion dollars for West Germany, 14 billion dollars for U.K. and slightly more than 7 billion dollars each for France and Italy. The Big Four of Europe (excluding Germany) devoted less than 2.5% of their GDP to R&D. If it would be legitimate to calculate an aggregate total of their R&D expenditures, the figure would amount to 54 billion dollars. This represents half of the U.S. figure and is only slightly higher than Japanese expenditures, even though the Big Four have a population which is twice that of Japan.

Smaller European countries like Sweden, Netherlands, Switzerland and Spain each devote between 2 and 4 billion dollars to R&D. Sweden reaches an exceptionally high R&D/GDP ratio of 3%. [4]

We must underscore the fact that the European setting still remains largely nationalistic: to calculate the aggregate total of R&D expenditures for the region would not be entirely legitimate.

2) The ratio of scientists and engineers engaged in R&D during 1988 represent per 10,000 people in the labor force: 44 in France, 52 in Germany, 35 in U.K., but 66 in U.S. and 67 in Japan.

3) West Germany and Japan are countries where the share of R&D financed by industry is the highest in the Western world: 62% and 69% respectively in 1986-87. Whereas during the same period, industry financed only 42% of R&D expenditures in France, 48% in U.S. and 50% in U.K. [5] Consequently, with a only a tiny difference in Germany, Western Europe countries suffer from a relatively low involvement in R&D both at the national and industry level.

4) According to P. de Woot and the University of Louvain research team, European business companies suffer from other weaknesses in some critical points such as the following:

-Over-centralization of R&D within a minority of big corporations;

-Too few small high-tech new ventures and small and medium sized companies

indulging in new technologies;

-Weak cooperation between small companies and higher education network;

-Insufficient capacity of business leaders for conceiving a world strategy;

-Market fragmentation;

-Heterogeneity of the European public regulations and the public sector buying

procedures.

Cooperation in technology and scientific applications between companies and universities **is a must** from the point of view of an European economist who thinks according to the criterions of efficiency and economic optimum. However, cooperation with other companies and research contracts with universities are viewed very often as a second best solution by the business executives in charge of implementing the cooperation scheme. For example, cooperation between business firms who compete on other grounds can alter competition and hinder the company's future autonomy. Cooperation with traditional universities is a source of friction due to the lack of common culture and the difference of values between the two types of personnel. The scientific researchers who are most appreciated by corporate staffs of successful companies have to be both excellent in their scientific achievements and careers, and deeply interested in the business strategy in which they play a key role. A researcher coming from the academic community has to comply with this implicit rule.[6]

There is a traditional view that European universities are not considered as major actors of technological progress nor a valuable partner for a corporation. But this traditional view is not equally shared in all European

countries or in all their regions, nor has it been an appropriate view for a few decades.

According to another more recent and simplistic opinion, university-business cooperation is a kind of panacea. This notion is simplistic because the excellent network which has strongly enhanced the socio-technic culture of Switzerland in pharmaceutics, chemicals and mechanical engineering did not prevent the watchmakers' industry to be ousted for a while by the Japanese competition in electronic watches. University and corporation may collaborate while lacking long range planning capacity. Therefore, if it is highly desirable to strengthen the links between two sectors on research issues, one should study carefully how each sector works and what are their conditions for success.

It is not easy to measure **the intensity of university-corporation cooperation in research** country by country. In some countries, informal links are strong, diverse and deeply influenced by a tradition of mutual interchange. Close, personal contacts between outstanding scholars and business leaders, clubs and associations are thus very numerous in Switzerland. From this old tradition stems a host of agreements on research grants, on technological consulting, on business participation to post-graduate teaching and the selection of the teaching staff, on material equipment transfers and so on. More institutionalized links follow quite naturally with the case of Polytechnikum of Zurich as a good example. And business companies may very well agree to share information on their own research activities.[7]

The British and French traditions relied on the opinion that Academia and Business lived in entirely separate worlds. The University of Grenoble and a few scientific departments in Paris University stayed for a long while almost as unique examples of spontaneous cooperation with the world of production. The impulse of the government or regional authorities has thus been required in both of these countries in order to trigger off cooperation between industry and faculties. France as well as Norway and Finland have taken regional development as a major goal for this cooperation. The new universities created in less developed areas such as the northern part of Scandinavia have helped to develop new forms of cooperation. In less industrialized countries such as

Ireland, the cooperation is also less developed. Inversely, the presence of university graduates who have become business leaders is a strong point of cooperation found in such cases as the universities of Chalmers in Sweden, Twente in Netherlands and Compiegne in France.

More generally, the need for cooperation in research is so intense, the university which is younger and more recently established is eager to enlarge its role beyond tradition and to participate in regional economic challenges and policies. The oldest universities are more reluctant to do so, except in the case of those which incorporate new kinds of institutes or departments open to new fields of investigation and scientific research.

Cooperation has taken so many different forms that it is impossible to reach general conclusions without some **classification** and **typology**. University/Corporation relationships are not only of a bilateral type. On the one hand, in countries where their cooperation remains weak and sporadic, the governments are trying to play an active role as a third partner through a variety of activities. They create information agencies such as A.R.I.S.T. in France or the centers of technology information in Bade Wurtenberg, Finland and Switzerland. They help to promote technopoles and scientific parks. They develop specific programs aimed at creating technological breakthroughs (for example, the science and engineering research council in U.K., programs of bio-technology in Netherlands, and software engineering in U.K. and Sweden). Financial incentives, contracts, specific training programs in industrial research (Denmark), all in varying measures of success, are additional modes of public intervention. In some cases, even in countries like Switzerland or West Germany where there is a strong attachment to market freedom, the federal authorities are pushing forward programs which aim at dealing with technology and knowledge transfers (programmes d'impulsion in Switzerland and a pilot program in consideration of new business companies which are "technologieorientierte" in Germany).

On the other hand, the bilateral agreements between a university and a corporation may be complicated by the fact that the university does not have a monopoly of basic research. France's C.N.R.S. has developed a system of several hundred research laboratories which are both in part completely

separate from universities and yet also linked with universities. Medical research, atomic energy and oceanography are also controlled in France by non-university public agencies which play a role in knowledge transfers and scientific cooperation with the production sector.

Two parameters seems to influence the type and the intensity of university-corporation relations. The size of the business firms and the rate of R&D to turnover or the degree of maturity of industry.[8] Large high-tech companies often control greater labs than their partners in higher education. They appreciate the need, however, to develop close links with different university departments -- such has been the case of Thomson in France. Large companies may be more advanced in methods and results in highly specialized fields, but they expect that university researchers will have the potential to catch up and to get ahead even further.

Big companies acting in more traditional branches of industry like the automotive field feel less involved in systematic cooperation especially with old type universities. There are, however, some exceptions to this situation such as the relationship between Volvo and the University of Chalmers in Sweden.

Small and medium size businesses in high-tech raise three issues in most European countries: 1) The availability of technological information; 2) The possibility of funding capital venture on research applications; 3) The entrepreneurship especially in the area where they have to make their procurements.

Small and medium size businesses which are conducting traditional activities are the most difficult to approach. In Germany, the University of Bochum and Dortmund have created a common industrial liaison unit called Unikontakt. In France, Finland and Switzerland some local business communities and associations (for example all the chambers of commerce) are dealing with this issue which is largely a problem of helping small businesses to conceive what could be their demand for newer technologies.

Finally, the content of cooperation touches different fields:

-Joint research contracts and subcontracting;

-Exchange of personnel;

-Consulting and auditing in technology;

-Exchange of information;

-Research grants;

-Material equipment gifts or lending;

-Unilateral or mutual participation in boards and scientific committees;

-Post-graduate training;

-Patent agreements;

-New ventures;

-Earmarked subsidies from the government.

The **success stories** show that ancientness of tradition in close contacts (as in Switzerland) is not at all a necessary condition for success. For example, there were practically no research structures in Denmark in the early 1960s and unlike Belgium and Netherlands, the country did not have very big companies. The Danish government launched some fifty technological institutes in two major cities which were given a large autonomy of management for contract work with industries and local authorities. The receptivity of the milieu of farmers and craftsmen as well as their strong entrepreneurial and technical culture helped them to create many linkages which now contribute to the dynamism of Denmark.[9]

Some time is needed, however, before success or failure may be evaluated. New technopoles like Sophia Antipolis in France need at least ten years before one can assess their results, their impact on innovation, business success, the new scientific curricula which derive from research, technological employment or derived jobs in complementary activities.[10]

Finally, the importance of collaboration should not only be assessed by pure R&D results. Technological diffusion through new kind of networks and communications media should also be considered. One could quote here the new experience of continuing education for advanced engineers which was launched two years ago in Europe under the acronym of program PACE.

My final comments will touch upon several problems:

1) Frictions concerning secrecy, publications policy and intellectual property exist but they can be overcome by appropriate patent agreements as has been the case in Switzerland, Germany and U.S. The intellectual property

system has to be reconsidered, however, in view of the fact that new technology in genetic engineering, for example, may become easy to replicate and thereby used for many industrial applications at low cost.

2) The efficiency of public research is not highly appreciated in countries where the weight of the public sector is considered as important. The results of a recent inquiry initiated by the French department of industry into the activities of three hundred large and medium sized corporations, reveals various attitudes held by the corporations concerning R&D.[11] Let me first state that this sample of corporations produces 50% of the total French exports of manufactured goods -- they are also more active and more technology-oriented than the average company. The corporations want an enforcement of public assistance to their R&D but express a negative appreciation of public research. Fifty-four percent think that such research does not help the competitiveness of the French industry and seventy-two percent think that it does not contribute to their future.

3) A more specific problem is the difficulty for European countries to transnationalize their activities. Internationalization of European technology has already begun in some areas. Three fields of precompetitive research involving universities labs are a) information technologies (Esprit program) b) telecommunications (RACE program) and c) manufacturing technology (BRITE program). There is also a program on competitive research called EUREKA where business companies keep the leadership but have also agreed to create consortia with other laboratories.

4) The importance of public research agencies and laboratories outside of universities in the European setting is reducing the share of research funds that are allocated to universities. This might become a problem to the extent that these specialized agencies struggle for survival and longevity, although they have played a very positive role as catalyzers in specific European projects such as those concerning the accelerator for nuclear energy and the satellite industry.

5) During the next decade, the student circulation within the EEC will increase. Countries such as Germany, where the rate of population growth is low, will contrast with countries such as Spain and France were the overall

population and the student population will grow rapidly. The latter countries could seize upon this as an opportunity to launch a new setting of technological universities and to close the gap which remains between higher education and the business corporations. Spanish law has recently decentralized the universities and completely modified their government structures. Their budgets are voted by regional councils composed mainly of outsiders coming from business, unions, administrations and so on.[12]

In a world which is more and more rapidly transformed by scientific research and even more by industrial R&D and innovation, research becomes at the same time a commonplace activity and a source of highly specific talents and valuable outputs. An indication of how commonplace this activity has become is that fact that the U.S. has more than 3,500,000 non-academic scientists and engineers, West Germany, U.K. and France more than 1,600,000 and Japan 1,500,000.[13] This means that the universities are no longer dominating research, if they ever did. Nor are they dominating the supply of scientific information, although they keep an important market share for basic research. This basic research is a valuable activity and a source of profit because technical innovation and technology are a powerful way to differentiate products and create new markets.

Even though the economic community is slow to respond, it is being solicited to cooperate with the universities because basic research is a potentially valuable source to tap. Business's traditional disinterestedness in this kind of research is challenged today by the development of new curricula in engineering sciences and business administration and also by the shortage of resources. New institutions are more able to see the opportunities of cooperation than older ones and are willing to collaborate in the creation of new micro-climates in technologically backward areas. To the extent that research must be excellent, older research universities, however, keep an advantage in the cooperation with big high-tech business firms. Whether the university is old or new, relevancy and excellence cannot always be combined within the institution. In addition to concerns over relevancy and excellence, European universities have made slow progress up to now in the art of communicating information and the results of their research activities.

Endnotes

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