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# Europe Report

## SCIENCE AND TECHNOLOGY





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# EUROPE REPORT

## SCIENCE AND TECHNOLOGY

### WEST EUROPE

EAST EUROPE

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WEST EUROPE/AEROSPACE

# FRG ARGUMENT FOR EUROPEAN SPACE ROLE

Rotterdam NRC HANDELSBLAD in Dutch 26 Jun 86 p 5

[Article by our correspondent Rob Meines: "Germans Want Western Europe to Become the Space Power of the 21st Century"]

[Text] The FRG must do much more than in the past to establish and support space projects, including a space center of its own, a sort of German NASA with substantial authority. This new German space policy should be the main force in Europe's acquiring autonomy in space. Western Europe must thus regard itself as the space power of the 21st century. These are the findings of a group of experts as published recently in a memorandum at the request of the research institute of the German Foreign Policy Association.

According to the experts from the parliamentary factions of the governing coalition and the SPD, from ministries, industry, the scientific community, and trade unions, a country's political position, prestige, and influence within the international community will in the future largely depend upon its capacity and willingness to explore space, to master the technologies required and to create the industrial base required.

Even a medium-sized power--in terms of global politics--such as the FRG will have to be fully aware of that situation. If the FRG's space potential is joined to and coordinated with that of the other European states, that would to some extent correct Western Europe's lag in space flight behind the superpowers. According to the memorandum, this would also promote European integration.

## Autonomy

This does not mean that cooperation in space between Western Europe and the United States will come to an end. This cooperation remains essential, but the United States would take Europe more seriously as a partner if it had a clear space potential of its own. According to the study, Western Europe must acquire space autonomy.

The authors point out that with respect to foreign policy and security, the use of space has substantially contributed to the conclusion of arms control and disarmament treaties over the last few years. They also say that it

makes possible the conclusion of additional treaties. According to the memorandum, the observation of military activities in East and West via spy satellites ("information satellites") and the rapid transmission of the acquired data through communications satellites can help reduce the amount of incorrect information and thus temper mutual distrust.

Western European Union

The authors therefore advocate the launching, under the auspices of the Western European Union, of a European military intelligence satellite to monitor compliance with arms control treaties. Professor Karl Kaiser, director of the research institute, explained: "Europe needs its own eye in space." The memorandum also advocates the use of "sensors" in space to defend against tactical nuclear missiles and cruise missiles (ATM system). Lothar Fischer and Karl-Heinz Klejdzinski, the two SPD MP's, adopted a minority standpoint rejecting this ATM system for Europe because they think it contravenes disarmament efforts.

One of the most specific proposals put forward in the memorandum of the German Foreign Policy Association involves FRG participation in the French Hermes space shuttle project. Bonn should take at least a 30-percent share in Hermes so as to have a real say in the project at the European level. The French have long been pressing for FRG participation, but Riesenhuber, the minister for science and technology, has so far been unwilling to go beyond participating in a study of the project's real cost and potential participants.

In Professor Kaiser's opinion it is a big mistake to render FRG participation in the project dependent on the financial feasibility of Hermes. "The decisive political question at issue is the formulation of a comprehensive long-term concept for the use of space. This use is not only important for the FRG from an economic and technology-policy point of view, but it is also essential in the field of foreign, security, development, and cultural policies." According to the study, it is essential that the FRG become an important partner in an "integrated European space power."

Finally, the study advocates the following details:

- Development of a European manned space station, besides participating in an international manned space station (Colombus);

- Further development of Europe's own Ariane 5 and Hermes spacecraft, up to and including space shuttles;

- Development of a satellite relay system for communication between ground stations and space systems;

- Development of European space-based military intelligence systems.

In addition to Professor Kaiser and the two aforementioned SPD members of Parliament, the research institute team also included the president of the association, Ambassador Guenther Diehl, Minister of State Lutz Stavenhagen, State Secretary Lother Ruehl, and Special Ambassador for Disarmament Affairs Friedrich Ruth.

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WEST EUROPE/CIVIL AVIATION

## AERITALIA PARTICIPATION IN AIRBUS, U.S. PROJECTS VIEWED

Rome IL POPOLO in Italian 31 Jul 86 p 3

[Excerpt] Aeritalia's determination to count on its own strength is indicated in the results of the company's increased civil [aviation] activities when compared to the company's total activity, an increase from 12 percent in 1971 to 32 percent in 1985. In the civil aviation sector Aeritalia is now involved with the American McDonnell Douglas (first, the DC and MD80; now the DC10), and Boeing in the B-767 program (as "program participant"). In Europe, Aeritalia is committed to the ATR-42, the regional transport aircraft which is developed and produced jointly with Aerospatiale of France.

Aeritalia believes that in the future the company will certainly participate in a program involving aircraft in the MD-11 (MD Douglas) and A-340 (Airbus consortium) class, i.e., aircraft just below the B-747 range. Talks are now in progress between MD Douglas and Airbus regarding this category of aircraft transportation and it is hoped that an agreement will be reached soon since market trends do not seem to allow room for two competitors. In any case, an agreement of this kind would guarantee Aeritalia's involvement in production and, at the same time, would show that Europe and the United States can be viewed as integrated, not alternative, choices for Aeritalia.

Aeritalia is also involved in the production of an airliner with 100-150 seats, propelled by a single motor, known as a propfan aircraft. MD Douglas, Aeritalia, the Chinese aeronautics ministry, and Sweden's SAAB have launched a joint program for the development of this type of aircraft. According to the agreements Aeritalia can participate in any of the future industrial programs.

Finally, regarding a regional transport aircraft with 40-80 seats, the company is involved with Aerospatiale in the ATR-42. Future prospects depend on the evolution of this program in relation also to additional civil and military versions within a family of aircraft, without excluding the possibility of involving new international partners in the program.

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WEST EUROPE/CIVIL AVIATION

## AERITALIA EXECUTIVE ON JOINT AERONAUTICS INDUSTRY VENTURES

Rome IL POPOLO in Italian 31 Jul 86 p 2

[Interview with Fausto Cereti, vice president and general manager of Aeritalia; date and place not given]

[Excerpts] [Question] Assuming that in the end cooperation between Boeing and McDonnell Douglas in the medium-large [aircraft] sector is not reached and that a Euro-American consortium is formed between McDonnell Douglas and Airbus, with whom would you cooperate?

[Answer] Given our cooperation experience with McDonnell Douglas, which we maintained together with Boeing -- managing to maintain good relationships with both although we initially were regarded with suspicion -- and given the friendly relationship with almost all the industries in the Airbus consortium, we would certainly be interested in working together in this new potential alliance. Although we currently do not work with the Airbus consortium, except on a smallscale compensation basis for Alitalia purchases which we handle, we cooperate with individual companies of the consortium. Suffice it to mention Tornado, EFA, and the ATR-42.

Given this state of affairs, we will certainly join the new group. In all likelihood, we will gradually participate in all the programs as the existing ones are replaced; therefore, it is not very likely that our relationship with Boeing will increase in the future even though B-767 production seems far from exhausted and I do not believe there will be a valid replacement in the next 25 years. Therefore, assuming that the B-767 will last another 25 years, our relationship with Boeing will carry on for at least as long.

At some point we will become Boeing suppliers only, which is somewhat different from being partners. But it is the normal development of relationships. At McDonnell Douglas we started by being simply parts suppliers, then we became involved a little in engineering, and now there's talk of becoming partners at all levels.

[Question] From this one could deduce that Aeritalia's strategy is choosing the program and not the company. By the way, what is the status of the joint project with the Chinese and Swedish for the development of the 150-seat propfan engine aircraft? I'm talking about the agreement which in a way is a

rival project to the agreement between Boeing and the Japanese, and which sees joint work by companies of three continents (the United States, Asia and Europe) in an intercontinental market. Could the fall in oil prices cause problems for this project since its chief attraction is low fuel consumption?

[Answer] Look, we are the country which gave birth to Giambattista Vico [an 18th century Italian philosopher]; we know that history repeats itself. Oil prices have gone up once and therefore they can increase again. Prices are falling now because the oil producers are trying to eliminate alternative sources of energy. Once they've established an oligopoly again, which is very likely given the ease with which we are abandoning alternative projects, fuel prices will go up. Therefore, we are hoping that in the mid-1990's the price of oil will be higher than it is today, thus compelling the use of more economical aircraft. Obviously, the aircraft of the future must be cheaper to run than present aircraft but it must not cost too much. What I mean is that the very high costs of the new propfan engine must be reduced. New technology is normally expensive at the beginning; eventually prices fall.

[Question] Also, there is the effect of the economy of scale which can be achieved as a result of mass production lines...

[Answer] This time the initial high cost of the propfan is also due to the fact that the propfan did not receive government subsidies since it did not enter into military propulsion programs, as other engines have. But let us talk about four-way cooperation, which is proceeding well. Sweden's SAAB has now joined the Italians, Chinese, and Americans in this agreement.

[Question] How is the work of the four manufacturers on the engine and airframe divided?

[Answer] General Electric is in charge of the engine, although a demonstration engine will fly on a Boeing in August. Through Alfa Romeo Avio we are in contact with General Electric for participation in engine production. Currently we are participating in the production at Sparrow Beach of aircraft equipped with the new engine which, according to engineers, should consume at least 40 percent less fuel. We are working on a demonstrator.

The demonstrator is a Douglas MD Super 80 -- on which are mounted pylons and the beams to attach the engines -- which we are constructing at Pomigliano d'Arco. We are producing the new piece. Recently, we built and delivered a large-scale model for tunnel testing. We will mount both the General Electric engine and its competitor, an engine jointly constructed by Allison and Pratt & Whitney, on this aircraft.

Technically and economically, both are fairly well balanced solutions. We want to try them both in order to find out whether one has an advantage over the other, and also to eventually offer the aircraft with both engine options. Currently, nearly all civil aircraft are sold with two and sometimes even three engine options; for example, the B-747, which is fitted with GE, Rolls Royce, and Pratt & Whitney engines.

[Question] Even Boeing is working on a similar type of propfan aircraft...

[Answer] Boeing is doing two things. Under a NASA contract it is building a demonstrator -- a B-747 -- with a GE engine. The results of this NASA contract will then be put at the disposal of all industries; written materials will be given to all industries cooperating with NASA. At the same time Boeing is working on a new series of aircraft for this new engine. In this connection, it has reached an agreement with the Japanese.

[Question] Aeritalia's role in airframe production is therefore clear. Also clear is the picture you have drawn on the process which leads to international cooperation in the aeronautics industry. What is now required is more information on what occurs in the engine production sector, beginning with Aeritalia's involvement through Alfa Avio.

[Answer] Alfa Avio has always made parts for civil aviation engines together with GE, initially in return for Alitalia purchases. We plan to continue along these lines. Obviously, we cannot expect massive participation because investment in this field is rather steep. It is known that in Italy Fiat Aviation also participates in engine production and is closely connected to Pratt & Whitney, Rolls Royce, and MTU, and now has a role in all Pratt & Whitney engines. Alfa Avio is bound to GE. Since, as I have mentioned, both propfan engines will be offered on all aircraft, it probably is reasonable for Italy to participate in both programs.

[Question] It is necessary and useful competition even for our domestic mechanical engineering industry...

[Answer] Competition which is also necessary to fix ceiling prices. Therefore, I believe that even though Italy particpates in two different engine production groups there is no possibility of incompatibility or friction; in fact, the relationship between Fiat Aviation and Alfa Avio is excellent. There is talk of countinuous cooperation because we also collaborate in the military sector.

[Question] If international cooperation is becoming a rule then all the more reason for domestic aeronautical industries to cooperate. What developments do you foresee as far as Aeritalia and Augusta and other small companies are concerned?

[Answer] Aeritalia practically ensures the presence of the Italian aeronautical industry in airframe production. Other companies have rarely taken part, therefore there are no problems as far as common international cooperation is concerned. Obviously, this is not the case when it comes to the military sector, but we are now discussing civil aviation.

As I mentioned, in the engine sector we essentially participate in Fiat's P&W program and in Alfa Avio's GE program. I believe this to be perfectly compatible when it is necessary to maintain a presence in both programs. What could be done is to improve the activity of other production units, especially in the aircraft sector; for example IAM in Brindisi is a traditional Aeritalia

subcontractor with whom we could cooperate even further. The fact that it is part of the Augusta Group should not prevent us.

I think the basic discussion concerns something else. It is not the rationalization of production and plants that one expects, but the rationalization of the decisionmaking and financial powers to enable participation in international discussions or negotiations with more contractual weight. In the aeronautics sector the large industrial groups are the ones that count and therefore the fact that we are divided means we have less contracting power. Better coordination, for the system of state shareholdings, means being under the same financial group. Since the centers of IRI and Efim operational coordination are financial companies, grouping them into one financial group which possibly has experience in the field seems logical. An example could be Finmeccanica, which has worked in this sector for years and has brought success to Aeritalia and therefore could bring success to others.

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WEST EUROPE/COMPUTERS

PHILIPS' DEKKER DISAVOWS TECHNOLOGY GAP

Oslo AFTENPOSTEN in Norwegian 3 Sep 86 p 35

[Article by Ulf Peter Hellstrøm: "Philips Chief Dekker: The Technology Gap Does Not Exist"]

[Text] The technology gap between Europe and the major powers of the USA and Japan does not exist. The European electronics industry will play a decisive role in the years up to the turn of the century. However, it is important that tariff barriers and other trade barriers be broken down so that the industry can tailor itself to a more uniform market. The departing head of the worldwide Philips concern, Wiese Dekker, says this in an interview with AFTENPOSTEN.

The Philips head used his term in the boss's seat of this major concern to direct a number of challenges to European politicians regarding elimination of the trade barriers which prevent European concerns from gaining access to a big market. Both Japanese and especially American firms have an important competitive advantage in the fact that they can turn to big domestic markets without having to think of tariff schedules, national monopolies or other barriers.

Philips Plan

A good year ago the Philips concern presented a special plan for how EC should remove such trade obstacles. The plan contains hundreds of proposals spread out over a time plane of the next few years. To the question of how quickly European political organs are actually working on these issues, Dekker says that actions are proceeding slowly.

"But it is progressing. Both initiatives by members of the EC Commission and the work in the EC bureaucracy show that they are aware of these problems. Philips' own 'Europe 1990' plan has also met positive reactions," the 62-year-old Dekker says. He himself comes from Eindhoven in the Netherlands, where the big concern has its headquarters. He began his career at Philips in 1948 and worked for many years in the Asia organization before he was called home to Europe and eventually he took over the boss's seat at the beginning of 1982.

Voting Goes Slowly

Dekker thinks that one of the main problems in EC in work on removing trade barriers is the very voting system.

The requirement of unanimous decisions delays the process considerably. "If we are to do away with 300 regulations in the years up to 1992, the politicians will have to settle about one regulation a week. This is difficult to implement without a system of majority decisions," the Philips chief says.

Another prominent leader of the European electronics industry, Bull Chief Jacques Stern, has made himself the spokesman for a joint effort between Europe's major firms for the establishment of a counterpart to the gigantic companies in the USA and Japan. Philips on its part has been in search of a joint effort with competitors in the USA and Japan. An example is the joint venture between Philips and the American AT & T telephone company.

"If one looks at developments in France in recent times, it appears as though there they are winking at matters with the many joint venture agreements which French industry has entered into with companies precisely in the USA and Japan. When one looks for joint venture partners one must, moreover, do it first and foremost out of regard for one's own strength. That is the most important thing. It would be crazy to isolate oneself and look for joint ventures only in Europe. In some areas this is natural, as in the joint venture between Philips and Siemens in microelectronics. In other areas it is more natural to look around other places, such as the joint venture between Philips and AT & T was an example of," Dekker believes.

Deregulation

The Philips chief believes that the deregulation of telecommunications in Europe is proceeding more quickly than he had expected. He points to the denationalization of British Telecom in Great Britain, the denationalization debate which is now taking place in the Netherlands and similar examples. "I think that everyone is gradually realizing that it is necessary to strive for a European market for the telecommunications industry. The time is past when it is possible to operate with several national companies in this branch of industry," Dekker says.

"I believe in continued concentration of the electronics industry in Europe," the Philips chief says. He points, among other things, to a similar development in the USA.

The Philips concern sponsors Hallvard Thoresen's employer, PSV Eindhoven, which this year became the series champion in Dutch soccer. Dekker says that the reason for Philips' involvement is not just of an economic nature, but is also due to the firm's deep roots in the Eindhoven district. "The company built schools and roads in the area in order to establish the necessary infrastructure. For this reason the company also participated in the beginning of sports clubs like PSV Eindhoven. It is hard to measure how much we will get back for the money which we are using for sports, but I do think that we will get it back," Dekker believes.

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WEST EUROPE/COMPUTERS

## NORSK DATA GAINS ON FOREIGN MARKETS

Oslo AFTENPOSTEN in Norwegian 2 Sep 86 p 44

[Article by Ulf Peter Hellstrøm: "Norsk Data Growing Abroad"]

[Text] The computer giant Norsk Data is continuing its growth, but first and foremost abroad. In Norway the growth in the receipt of orders has stagnated in comparison with the billion-kroner-concern's record years of 1984 and 1985. The drop in oil prices and the gloomy economic outlook are the main reasons that Norwegian concerns have been reserved in their investments, Norsk Data believes. The half-year figures, all the same, show continued strong growth in sales and especially in earnings.

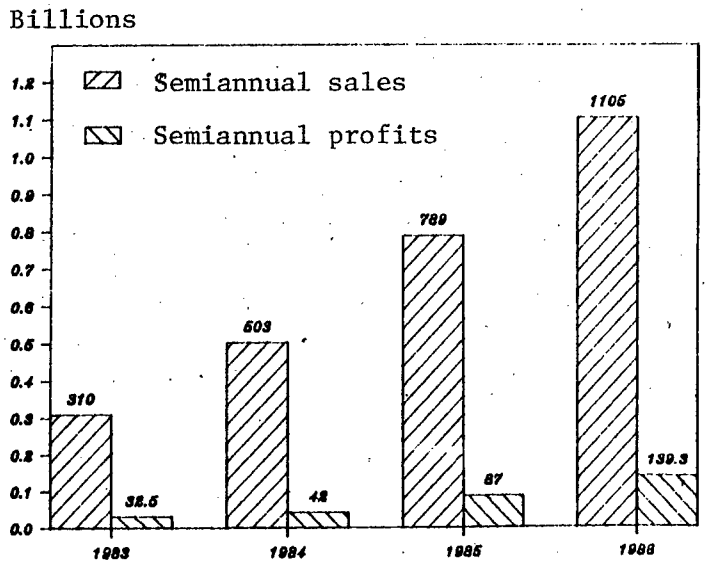
Net revenues in the first half-year equaled 1.105 billion kroner, and this represented growth of about 40 percent as compared with the equivalent period last year. Net profits were 139.3 million, while financial holdings produced revenues of close to 29 million. Profits before annual adjustments increased by 48 percent to 164.8 million kroner. If the computer concern achieves such good growth in the calendar year's last six months as the company has traditionally experienced, it can involve an annual profit which will not be so far from a half billion kroner.

The receipt of orders increased by 20 percent to 1.169 billion kroner worth in the first half-year, when maintenance contracts, customer training and other revenue are included. The receipt of orders for computer equipment itself, however, increased by only 10 percent to close to 900 million kroner. Major differences in the desire to invest in Norsk Data's various markets lie behind these figures.

"Reserved in Norway"

"The receipt of orders in Norway has been about the same as in the equivalent period of last year," it reads in Norsk Data's press release. Marketing Director Åsmund Sløgedal says that Norwegian concerns have become reserved in their investments this year because of the worsened Norwegian economy. "However, we are experiencing very strong growth abroad, especially in Great Britain, where growth so far this year has been over 100 percent," Sløgedal says. Norsk Data has also been taking market shares in countries like Denmark, West Germany and France; and, besides, the company has signed a

contract with an Indian State electronics concern which will give the Norwegian company a one-time sum of 36 million kroner--which was not included in the semiannual figures--and expected sales of 100 million kroner per year.




Norsk Data is continuing to grow both in semiannual sales and profits.

Norsk Data's management expects considerably improved profits in the second half of the year, because revenues are unevenly distributed between the two periods, whereas costs are more evenly distributed. The company is still using about 10 percent of its net revenues on research and development. Operations within research and development are now employing probably more than 500 people at home and abroad. The computer concern has become a major employer, with over 3300 employees. This is a growth of 500 people since the new year, but part of this personnel explosion can be explained by the fact that Norsk Data is now consolidating the Danish Data-Inform company with over 170 employees.

Stock Up

Stock quotations rose by 8.5 kroner to about 220 kroner for A-stock. The quotation drop just before the holiday was thereby offset to a great extent.

Norsk Data has been noticing great interest in computerized solutions aimed at office work. Here the company's Notis [Notice] system is a catchword. In West Germany the company is experiencing successes with the Technovision system, which is an aid in computer-aided design and manufacturing (CAD/CAM). Also, the ND Comtec unit's sales of computer equipment for newspapers and graphic arts firms are increasing strongly, especially in England.

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WEST EUROPE/COMPUTERS

## MARKET ANALYSIS FOR DATA PROCESSING EQUIPMENT IN ITALY

Milan INFORMATICA 70 in Italian Jun 86 pp 44-50

[Unsigned article: "Market Analysis--All the 1985 Figures From ASSINFORM"]

[Text] At a meeting held in Milan ASSINFORM presented its 1986 Report on the Data Processing Situation in Italy." Addresses were presented in connection with the theme of the meeting, data processing as a factor in the transformation of society in Italy, by Ottorino Beltrami, president of ASSOLOMBARDA [Lombardy Manufacturers' Association], Giancarlo Mazzocchi, coordinator of the Milan Project, Pier Luigi Torrani, president of IRRER, and Giorgio Pacifici of the Data Processing and Telematics Observatory of the office of chairman of the council of ministers. The information on the data processing and telematics situation in Italy contained in the report was presented by Giancarlo Capitano of Nomos Sistema and Francois de Brabant of Reseau, the two research companies who collaborated in drafting the report.

In 1985 the data processing network registered a growth in monetary terms of 25.3 percent, slightly lower than that recorded in 1984. The software and data processing services sector captured a market share of 33.7 percent in 1985, as against 31.8 percent in 1984, while hardware dropped in the aggregate from 68.2 percent over the same period. In terms of values at current prices, the Italian data processing market achieved an aggregate volume of 9.65 billion lire in 1985, as against 7.7 billion in 1984. Of this amount, the hardware component had a market value of 6.4 billion lire and the software and data processing services component 3.25 billion lire.

As all these figures show, the Italian data processing market, fourth in Europe in 1985, has grown to a respectable size. Measured in terms of the GNP (gross national product), total outlays for data processing products and services represented 1.25 percent in 1985 and rose to 1.41 percent in 1985. The percentage of the GNP represented by investments in hardware alone increased from 16.2 percent in 1984 to 16.7 percent in 1985. This indicates on one hand the significant share of data processing investments in total investments in machinery, this being symptomatic of a generally innovative attitude on the part of the Italian economic system, and on the other a very sharp growth of investments in machinery (+18.8 percent at current 1985 prices) in general rather than a growth of investments in data processing.

As has already happened in the leading countries, the cycle of investment in data processing appears to have been linked and correlated on a stable basis in 1985 with the more general cycle of investments in machinery.

Production and Employment

The generally good progress of the sector in 1985 is confirmed by the progress of industrial production in the sector of EDP systems and office machines, which, according to preliminary estimates, increased 36 percent in terms of value relative to 1984. This aggregate figure nevertheless represents the total of two highly different growth figures, one relating to office machine production, which in 1985 dropped 7.6 percent in response to the low demand, for typewriters in particular, expressed on both the domestic and foreign markets, and the other relating to the manufacture of EDP systems, which rose a good 45.8 percent. The last-named figure conversely reflects the good growth registered in 1985 on both the Italian and foreign markets in the demand for personal computers and minicomputers, of which Italy is a traditional producer.

There has also been positive growth of employment in the sector, estimated to be around 5.5 percent in 1985 over 1984. In absolute terms, the number of employees of hardware suppliers is estimated to have risen from 47,000 in 1984 to 49,500 in 1985.

Foreign Trade and the Trade Balance

In 1985 the Italian balance of trade in the office machine and data processing sector recorded a debit of 1102.2 billion lire reflecting a decrease of 5.8 percent relative to 1984, in which year the debit amounted to 1178 billion. Exports rose 55.7 percent in value, at a rate significantly higher than imports (+36.3 percent).

Analysis of the trend of foreign trade by product category, even in the context of a situation of structural dependence on foreign suppliers for processors and their peripherals, shows a very dynamic situation precisely in the computer sector. Exports in this product sector in fact increased to a value higher than the sector average (+57.8 percent), while the increases in imports conversely were below the average (34.1 percent). This positive indicator seems to be attributable largely to exports of personal computers to the United States and the major European countries and to exports of lower capacity minicomputers.

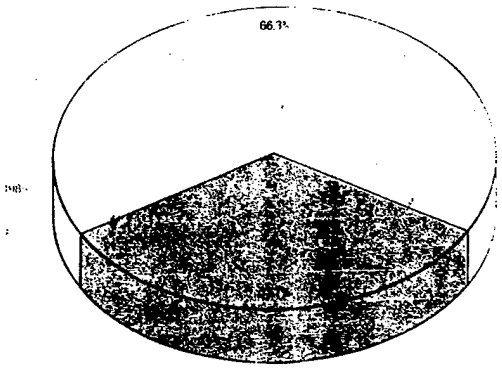
The slowdown in imports of data processing systems, on the other hand, is probably to be attributed to the relatively sluggish growth of the mainframe computer market due to the long wait for shipments of new products. This should lead to a higher volume of imports in 1986.

Conversely, the typewriter segment shows a significant drop in exports (-7.3 percent), along with an increase of 10.4 percent in imports. The typewriter market, especially in the lower electromechanical technology segment, is more or less stagnant, and in the segment made up of electronic technology products is to some extent faced with competition from Southeast Asian countries. One segment in which Italy is highly dependent on foreign markets is that of photocopy machines; the trade deficit in this segment amounted to

355 billion lire at the end of 1985, compared to 240.3 billion in 1984, an increase in value of 47.7 percent. Imports have, in fact, increased at a rate much higher than the average (+50.2 percent).

(1) **Struttura interna del mercato dell'informatica in Italia (1984-1985)**

| (2) Dati in miliardi di lire | 1984 | 1985 |
|---|---|---|
| (3) Valore totale | 7.700 | 9.650 |
| Hardware | 68,2% | 66,3% |
| (4) Software e servizi informatica | 31,8% | 33,7% |



(5) *Fonte: Nomos Sistema*

Key:

1. Internal structure of data processing market in Italy (1984-1985)
2. Figures in billions of lei
3. Total value
4. Software and data processing services
5. Source: Nomos Sistema

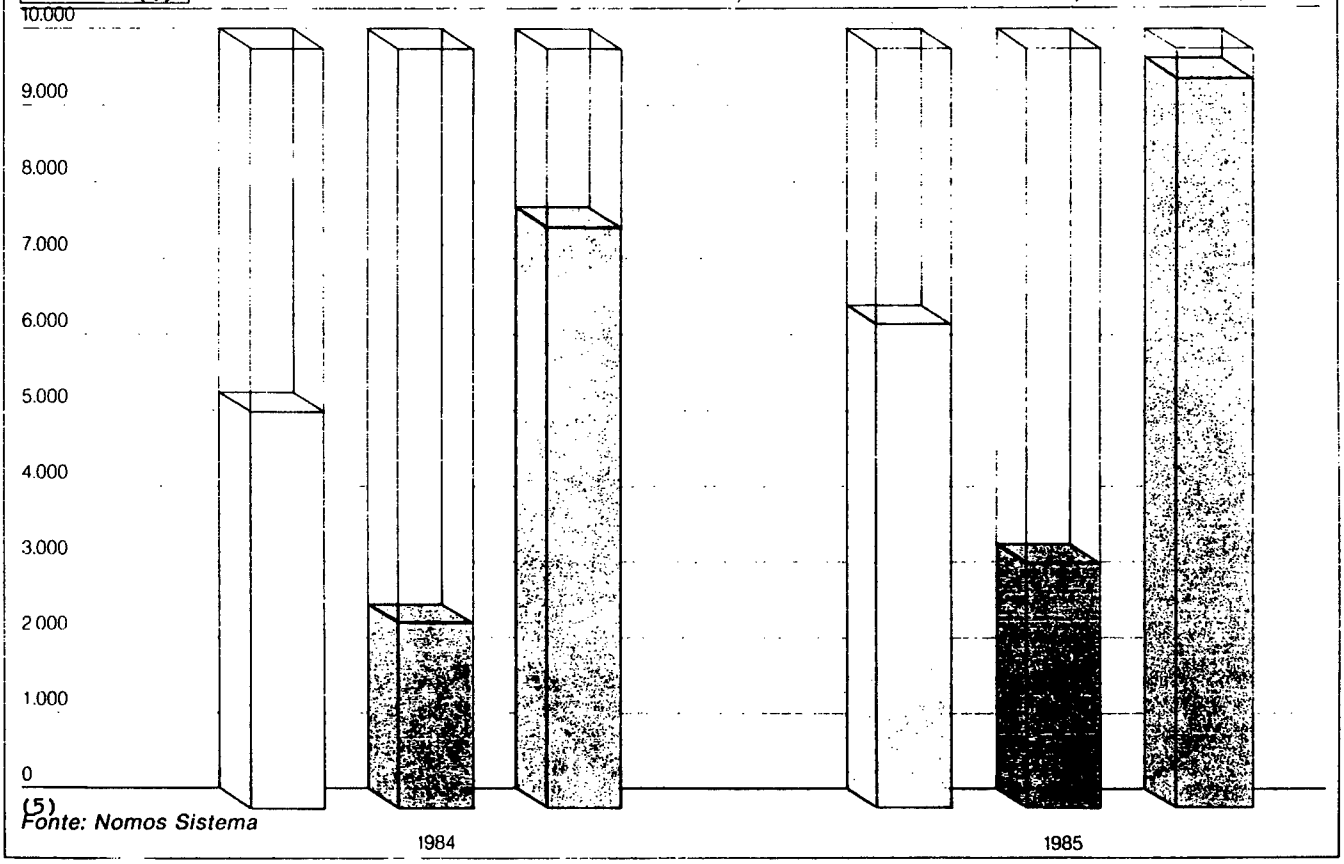
Growth of the Sector by Product Group

The progress of the market in individual product groups in the area of data processing systems shows that the most dynamic groups are those at the two extremes of the ASSINFORM classification, home hobby computers, and above all personal computers, at one end, and large and very large mainframes at the other. The sales of low-capacity minicomputers have shown good growth more typical of superminis and small to medium-sized general-purpose computers. For home computers 1985 was a year of more typical growth than the previous year due not so much to a slackening of demand, a phenomenon of an organic nature following the 1984 boom, as to a growing inclination by the user to purchase systems with more powerful functions and greater memory capacity, a phenomenon widely observed, although in different forms, on the personal computer market as well. The personal computer segment registered a good rate of growth (+63 percent in terms of volume), with around 150,000 units sold, compared to 92,000 in 1984. This trend was opposite that on more mature markets such as the one in the United States.

The dynamics of the home and personal computer markets in 1985 permits the assumption that the process of large-scale distribution of data processing equipment in Italy is coming to the end of the extensive phase and entering an intensive phase characterized by increase in the power and performance of the systems installed.

(1) **Mercato italiano dell'informatica (1984-1985)**

| (2) Dati in miliardi di lire | 1984 | % | 1985 | % | Δ%85/84 |
|---|---|---|---|---|---|
| Hardware | 5.250 | 68,2 | 6.400 | 66,3 | +21,9% |
| (3) Software e servizi | 2.450 | 31,8 | 3.250 | 33,7 | +32,6% |
| (4) Totale | 7.700 | 100,0 | 9.650 | 100,0 | +25,3% |




(5) *Fonte: Nomos Sistema*

Key:

1. Italian data processing market (1984-1985)
2. Figures in billions of lire
3. Software and services
4. Total
5. Source: Nomos Sistema

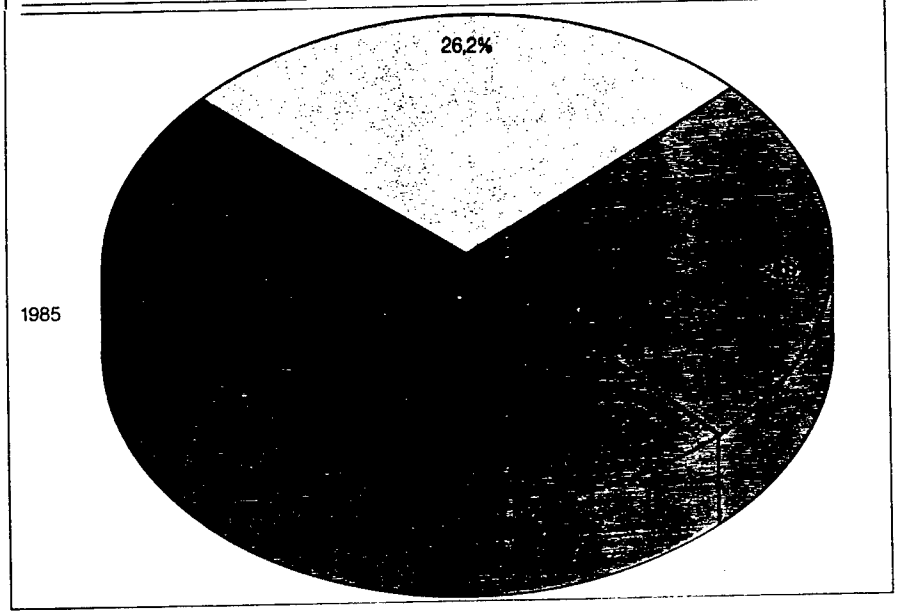
The progress of the minicomputer segment has also been highly satisfactory, above all at the lowest end, because of two synergic factors, the availability at decreasing prices of systems capable of increasing performance and the improvement in the responsiveness of the distribution network on the supply side, together with the strong inclination toward investment of the small to medium-sized user who already has equipment and the one who is buying equipment for the first time, in accordance with the generally good dynamics of investment in machinery and equipment.

Mainframes represent a segment whose growth in 1985 is measiurable not so much in increase in the number of systems as in the significant rise in the computing power power per unit installed.

The power requirement set for such systems is due to the increase in individual data processing in large firms and to more and more extensive adoption of highly sophisticated software tools in such firms.

(1) **Mercato italiano dei servizi di informatica (1984-1985)**

| (2) Settori di attività | 1984 | 1985 | Δ%85/84 |
|---|---|---|---|
| (3) Elaborazione dati | 30,9% | 26,2% | +12,9% |
| (4) Prodotti software | 24,1% | 24,9% | +37,7% |
| (5) Servizi professionali | 24,7% | 26,1% | +40,2% |
| (6) Sistemi integrati | 20,3% | 22,8% | +49,4% |
| (7) Totale | 100,0 | 100,0 | +32,6% |




Notes: The data include services provided by hardware manufacturers. The estimated captive turnover amount of companies controlled by groups that provide services inside the group to which the companies belong (such as the FINSIEL group, ENIDATA, etc) has been deducted from the figures. The figures also include amounts of hardware sold.

Key:

1. Italian data processing services market (1984-1985)
2. Sectors of activity
3. Data processing
4. Software products
5. Professional services
6. Integrated systems
7. Total

Telematics Situation and Trends in Italy

The concept of telematics, a term widely used in countries where languages derived from Latin are spoken but unknown in the Anglosaxon world, refers, as we know, to a union of two worlds in the electronics sector, that of informatics or data processing technology, with telecommunications, the

technology of data transmission, which is capable of generating products and services directly for a large number of users. It should be noted that, at the international level, the telematics market blossomed toward the end of the 1970's as a result of widespread use of certain technological innovations (microelectronics, optical fibers) and the need of telecommunications operators to saturate networks with uses in addition to the traditional basic telephone service. The development of the new technologies brought with it an increase in the number of options offered to users from the viewpoint of the solutions available for their communications problems and, at the public level, discussion of the monopoly of telecommunications services characteristic of the Western European countries, but of the United States and Japan as well.

While the United Kingdom, the United States, and Japan took significant steps toward liberalizing supply of equipment and services under a new set of rules, the European monopolies also underwent direct processes of conversion, in the countries allowing such an option, to provision of new services with higher efficiency and promptness than in the past. While, with the partial exception of the United Kingdom, there has been no questioning of the monopoly of basic and special networks, which require heavy investment and do not allow immediate return on investment, supply of new telematics services directly to the private market has flourished throughout Europe.

Teletex, mobile radio and radio paging, videotex, and teletex are even now arousing the interest of several thousand users in each of the countries of Europe, in many of which the experimental stage has already been completed and regular services have been established. France, the United Kingdom, and the FRG have also promoted long-term programs for use of wideband cable networks over large areas of their territory which are of interest even now to more than a million users per country (130,000 in the United Kingdom alone).

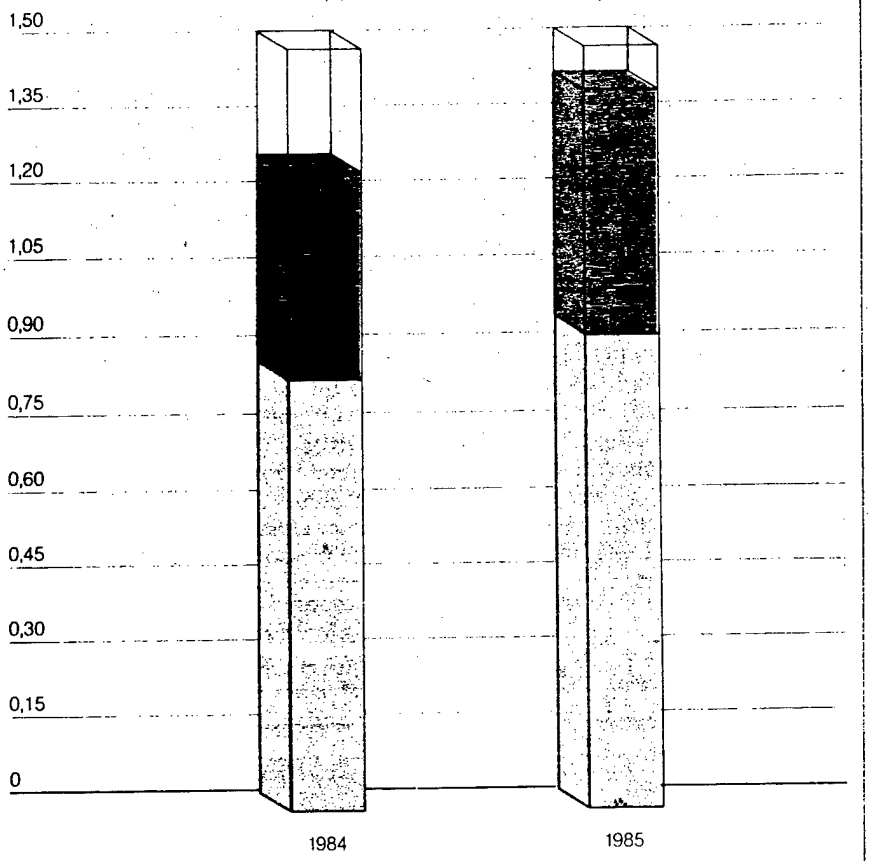
It should also be pointed out that the EEC telecommunications policy has not yet managed to go beyond approval of regulations which to a very limited extent open the national markets for central exchanges and terminals to competition. Consequently, significant technical obstacles to trade persist, such as the lack of standardization of the plugs that connect equipment to the network and of response tones.

Lack of uniformity still persists in availability of services from one European country to another and in the level of liberalization of some items of basic equipment (for example, telexes and modems are subject to monopoly in 5 out of 10 countries investigated, while the first telephone set is still subject to monopoly in all the countries).

The forms of evolution of "deregulation" in the various European countries are another element of openness in comparison to the previous situation and consequently make it increasingly difficult for the growing number of users operating on an international basis to develop their own integrated telecommunications systems.

(1) **Incidenza della spesa di prodotti e servizi di informatica sul Prodotto Interno Lordo (1984-1985)**

| (2) Dati in % sul PIL | 1984 | 1985 |
|---|---|---|
| (3) Spesa per hardware | 0,85 | 0,93 |
| (4) Spesa per software e servizi | 0,40 | 0,48 |
| (5) Spesa totale | 1,25 | 1,41 |



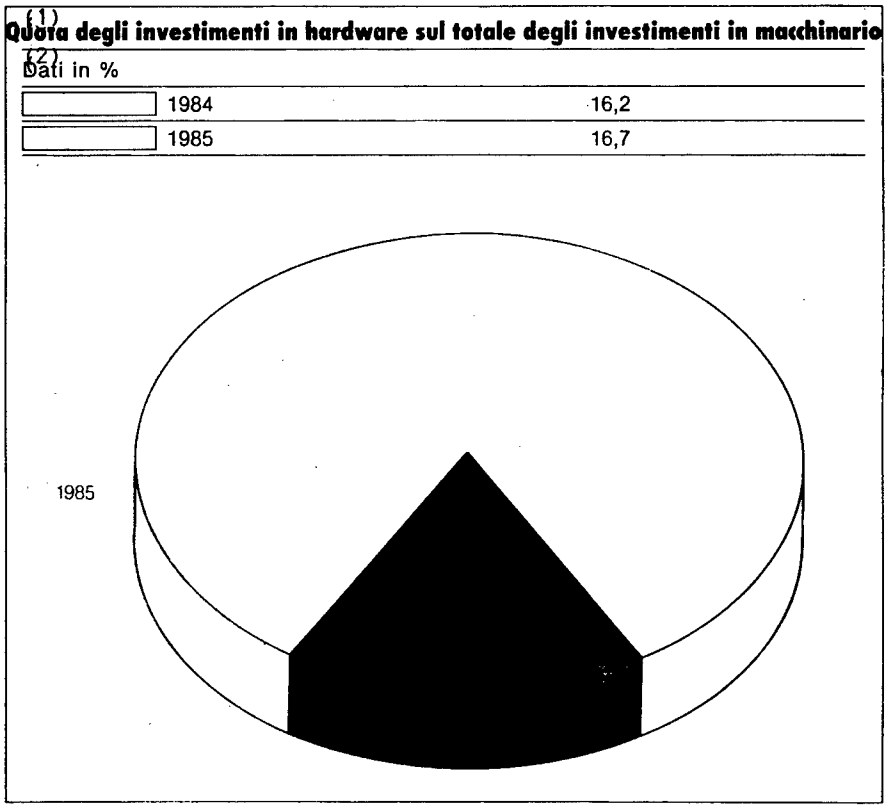

Key:

1. Share of expenditures for data processing products and services in gross national (1984-1985)
2. Figures in percentage of GNP
3. Expenditures for hardware
4. Expenditures for software and services
5. Total expenditures

The Esprit and Race programs, of which the latter is dedicated exclusively to telecommunications, do not seem to satsify fully the research and development support needs of EEC enterprises, inasmuch as they are based on the assumption that the financial projects involve precompetitive technologies. We note that the object of the Race project is development in the 1990's of a European wideband communications system integrating voice, data, and images, at a total cost for which all the funds, 1300 million lire in 5 years, has not yet been found.

The Italian telecommunications situation is characterized by an investment lag in special-purpose networks and new telematics services. This lag is explained essentially by the special institutional status of the national

telecommunications system, which is characterized by the presence of five entities operating networks and services, and by the financial problems encountered in the recent past by the operating entities in question because of the intricacy of the mechanisms set up for revision of rates for basic services.




Key:

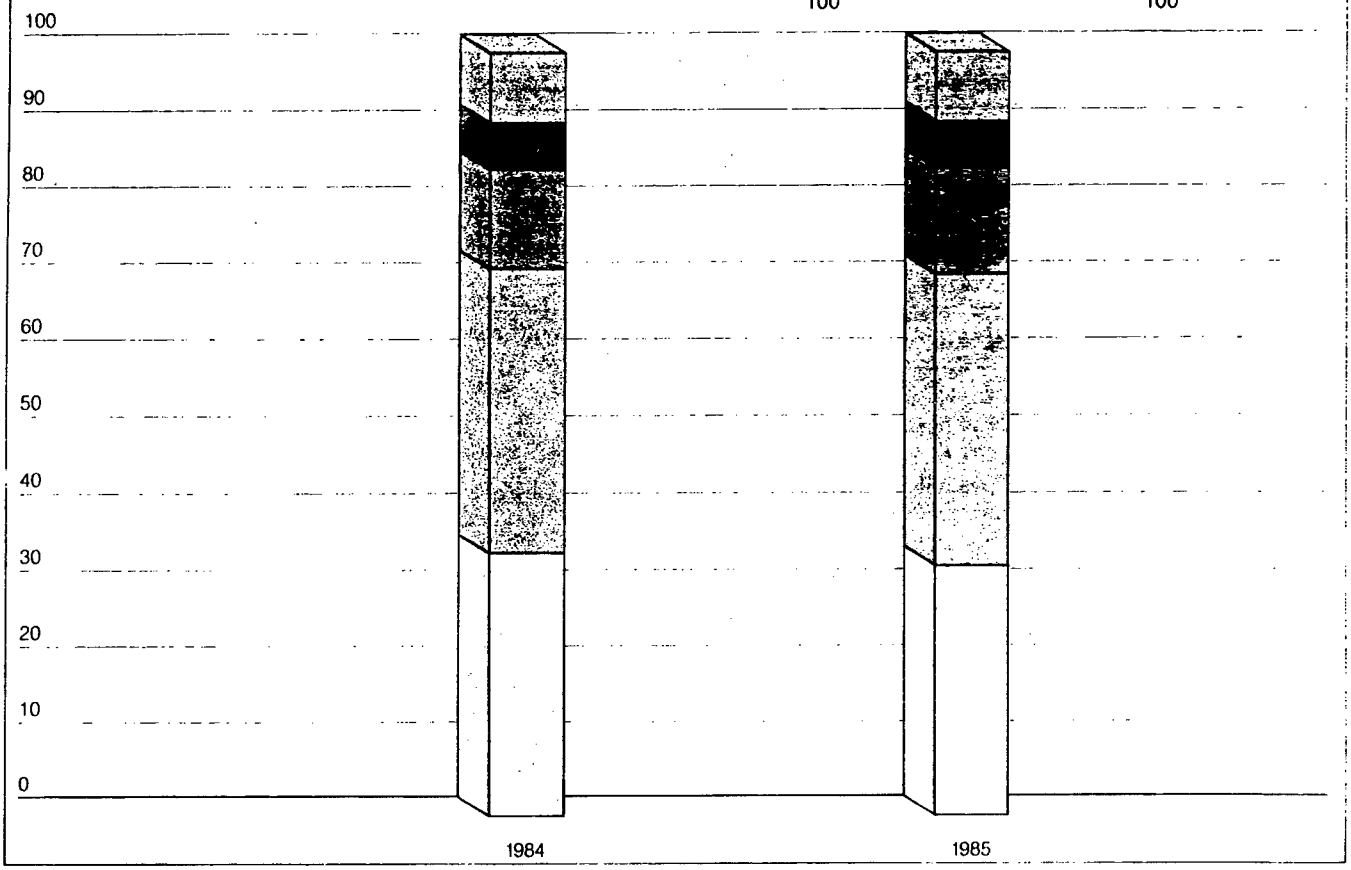
1. Share of hardware investments 2. Figures in percent in total machinery investments

The problems encountered in starting up a public videotex and teletext service, the small number of current and projected users of such services by the mid-1990's in comparison to the current levels in other European countries, and the delay in starting up the Itapac package switching network are deterring users from applying innovative technologies to the full in their professional activities.

The scheduled status reform contained in the draft law drawn up by postal and telecommunications minister Gava, which should end the multiplicity of operating entities, is encountering initialization difficulties and will not yield its first results for 5 years. The national telecommunications plan which was drawn up by the government at the end of 1984 and is to be in effect from 1985 to 1994 calls for increased investments in this sector. Over the next decade the investments should amount to 100,000 billion lire, including investments by private users.

(1) **Struttura dell'utenza di sistemi general purpose in Italia per settore economico (1984-1985)**

| (2) Dati in % | (3) Settori | 1984 | 1985 |
|---|---|---|---|
| | (4) Finanza | 35 | 33 |
| | (5) Industria | 37 | 38 |
| | (6) Commercio e servizi | 13 | 14 |
| | (7) Pubblica Amministrazione Centrale | 6 | 6 |
| | (8) Pubblica Amministrazione Locale | 9 | 9 |
| | | 100 | 100 |




Key:

1. Use structure of general-purpose systems in Italy by economic sector (1984-1985)
2. Figures in percent
3. Sectors
4. Finance
5. Industry
6. Trade and services
7. Central public administration
8. Local public administration

Telephone service will continue to be the basic service, use of which will increase on the average by 4.2 percent. Telephone density will rise from the current 29 subscribers per 100 inhabitants to around 43 in 1994 (this level of use is lower than the current level in Switzerland and slightly higher than the French and German levels at the end of 1984). The videotex use levels are also wholly inadequate to stimulate investment in the service by information providers. At the end of the period there would be 250,000 users, compared to more than 500,000 current users of the service in France, Germany, and the United Kingdom. Investments in local networks and private exchanges will increase over the period to reach 5 percent of public and private investments and 13 percent of total investments in user systems.

(1) **Bilancia commerciale italiana nel settore macchine per ufficio e sistemi di informatica (1980-1985)**

| (2) Dati in miliardi di lire | (3) anno | (4) macchine per scrivere | (5) macchine da calcolo registratori di cassa affrancatrici | (6) elaboratori e loro periferiche | (7) macchine per indirizzi duplicatori, altre macchine per ufficio | (8) macchine per fotocopie | (9) parti | (10) totale |
|---|---|---|---|---|---|---|---|---|
| (11) Esportazione | 1980 | 161,2 | 113,6 | 593,9 | 25,3 | 15,6 | 205,7 | 1.115,3 |
| | 1981 | 171,1 | 56,1 | 796,2 | 17,4 | 20,9 | 286,1 | 1.347,8 |
| | 1982 | 202,9 | 96,9 | 991,4 | 16,3 | 23,5 | 414,6 | 1.745,6 |
| | 1983 | 213,1 | 84,8 | 1.136,9 | 17,4 | 21,4 | 536,9 | 2.010,5 |
| | 1984 | 258,8 | 64,6 | 1.463,3 | 21,7 | 19,1 | 721,1 | 2.548,6 |
| | 1985 | 240,1 | 63,4 | 2.308,2 | 22,7 | 34,6 | 1.298,3 | 3.967,3 |
| (12) Importazione | 1980 | 51,4 | 85,9 | 759,6 | 18,6 | 136,6 | 431,2 | 1.483,3 |
| | 1981 | 58,2 | 94,7 | 1.028,8 | 19,8 | 153,3 | 517,2 | 1.872,0 |
| | 1982 | 50,1 | 93,6 | 1.138,5 | 21,6 | 167,3 | 654,3 | 2.125,4 |
| | 1983 | 64,7 | 96,2 | 1.381,4 | 23,7 | 189,5 | 719,2 | 2.474,7 |
| | 1984 | 86,4 | 217,5 | 2.236,7 | 33,4 | 259,4 | 893,2 | 3.726,6 |
| | 1985 | 104,7 | 196,1 | 2.998,6 | 35,8 | 389,7 | 1.352,6 | 5.077,5 |
| (13) Saldo | 1980 | + 109,8 | + 27,7 | — 165,7 | + 6,7 | —121,0 | — 225,5 | — 368,0 |
| | 1981 | + 112,9 | — 38,6 | — 232,6 | — 2,4 | —132,4 | — 231,1 | — 524,2 |
| | 1982 | + 152,8 | + 3,3 | — 147,1 | — 5,3 | —143,8 | — 239,7 | — 379,8 |
| | 1983 | + 148,4 | — 11,4 | — 244,5 | — 6,3 | —168,1 | — 182,3 | — 464,2 |
| | 1984 | + 172,4 | —152,9 | — 773,4 | —11,7 | —240,3 | — 172,1 | —1.178,0 |
| | 1985 | + 135,4 | —132,7 | — 690,4 | —13,1 | —355,1 | — 54,3 | —1.110,2 |

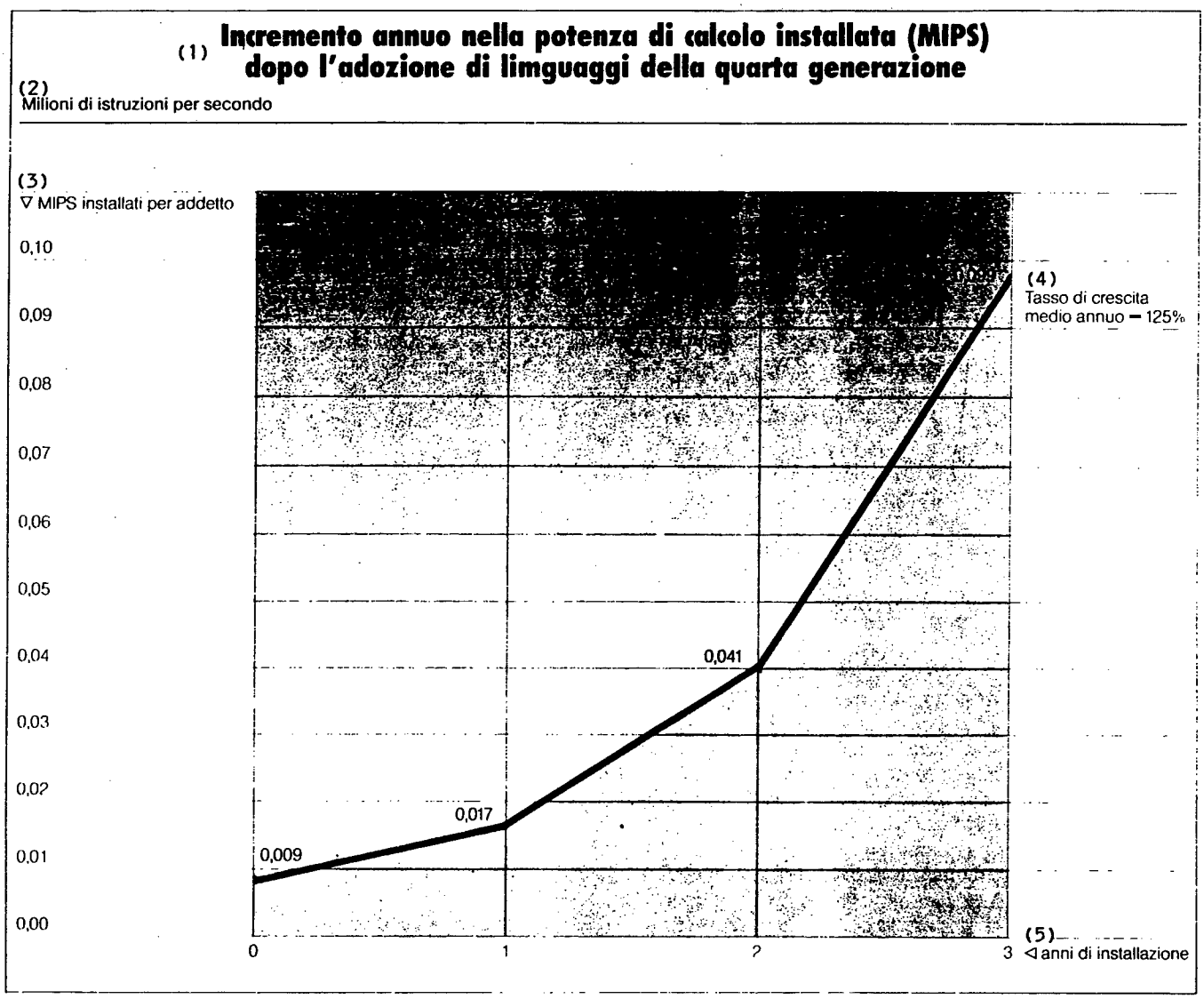
Key:

1. Italian trade balance in office machine and data processing systems sector (1980-1985)
2. Figures in billions of lire
3. Year
4. Typewriters
5. Calculators, cash registers, postage meters
6. Computers and peripherals
7. Addressing machines, duplicators, other office machines
8. Photocopy machines
9. Parts
10. Total
11. Exports
12. Imports
13. Balance

The assumptions of the plan were scrutinized in 1985 by a ministerial commission for the industry charged with studying the possibility of supporting development of the Italian telecommunications industry. This commission suggested the possibility of speeding up investment in the sector by increasing the amount invested over the period 30 percent relative to that stipulated in the plan and assigning priority above all to software demand, private networks, and satellite communications.

Adoption of the accelerated model, not yet approved at the end of February 1986 by the Postal Ministry in a version of the plan that was to have been approved by the end of 1985, assumes provision of incentives to use of new services by "business" users and start-up of telematic services within

public administrative bodies, along with the launching of initiatives promoting research and development by suppliers.




Key: 1. Annual increase in installed computer power (MIPS) following adoption of 4th-generation languages
2. Millions of instructions per second
3. MIPS installed per subscriber
4. Average annual growth rate = 125 percent
5. Years installed

Launching of an active policy of support for telematics requires identification of the snags and problems impeding the natural development of this market in Italy. The greatest snags are represented by the absence of an industrial policy for guidance of business firm policies and by a rate policy that penalizes "business" use and many new services. There is also an absence of precise rules regulating the relationship between operating

entities and the remainder of the supply sector with respect to the liberalized products and services.

The problems encountered in training human resources capable of managing the innovations are common to all operators, on both the supply side and the demand side, while the marketing policies of many firms seem not yet to have accepted the need for establishing a relationship with the market oriented more toward interpretation of user needs and toward after-sale assistance.

Supply Situation of Telecommunications Services in European Countries

**La situazione dell'offerta di alcuni servizi di telecomunicazione nei paesi europei**

| | Servizi | B | D | DK | F | GB | GR | I | IRL | L | NL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (2) | Telefono | • | • | • | • | • | • | • | • | • | • |
| (3) | Telex | • | • | • | • | • | • | • | • | • | • |
| (4) | Rete T.D. a circuito | | • | • | • | | | • | | | |
| (5) | Rete T.D. a pacchetto | • | • | • | • | • | | • | | • | • |
| (6) | Videotex | | • | | • | • | | | | | • |
| (7) | Teletext | • | • | • | | • | | • | | | • |
| (8) | Videoconferenza | | | • | • | • | | | | | |
| (9) | Teletex su rete telefono | | | | • | • | | | | | |
| (10) | Teletex su rete T.D. circuito | | • | • | | | | | | | |
| (11) | Teletex su rete T.D. pacchetto | • | • | | | • | | | | | |
| (12) | Conversione telex-teletex | • | | | • | | | | | | |
| (13) | Conferenza per telefono | | • | • | • | • | | | | • | • |
| (14) | Radiotelefono (auto) | • | • | • | | | | • | | | |
| (15) | Radiotelefono (treno) | | • | • | | • | | | | | |

Non vengono segnalate le sperimentazioni in corso, ma solo i servizi regolari.
*Fonte:* Leonardi - Rapporto sulle telecomunicazioni alla Commissione CEE (presentato nel maggio 1985).

Only regular services, not experiments currently in progress, have been included.
Source: Leonardi, "Rapporto sulle telecomunicazioni alla Commissione CEE" [Report to the EEC Commission on Telecommunications] (submitted in May 1985)

Key:

1. Services
2. Telephone
3. Telex
4. T.D. circuit network
5. T.D. package network
6. Videotex
7. Teletex
8. Videoconferencing
9. Teletex over telephone network
10. Teletext over circuit T.D. network
11. Teletex over package T.D. network
12. Telex to teletex conversion
13. Telephone conferencing
14. Radiotelephone (auto)
15. Radiotelephone (train)

The government and administrative bodies obviously play the most important part in removing the obstacles impeding the growth of Italian telematics,

but suppliers can also play a part in establishing standards, marketing policies, and product range, and in training human resources.

It is not easy to determine the dimensions of the telematics sector. In fact, the manufacturers active in this field are also suppliers of traditional data processing and telecommunications equipment. There are still 55 companies offering telematics equipment on the Italian market which engage in manufacturing and/or marketing activities. Each of the companies is involved with more than one product or service. The sector with the largest number of suppliers is that of private exchanges and intercom systems (18 and 19 respectively), while only two are telemedical equipment suppliers and six videotape manufacturers.

Moreover, not until recently did the first companies dealing in value-added services make their appearance on the market (computer hardware and software companies, financial services, and information and distribution companies). The approach to the telematics market, which is highly fragmented and diverse in its organization of applications, is in fact in need of forms of integration among suppliers and increasingly complex professional fields.

The most interesting sectors for Italian telematics, in view of the particular features of the Italian economic and production structure, include electronic funds transfer or electronic currency distribution, tourismatics, that is, tourist data management by electronic means, and regional telematics, which is particularly well suited to the monocultural geographic areas in which Italy abounds.

6115
CSO: 3698/659

WEST EUROPE/MICROELECTRONICS

## BRITISH ALVEY PROGRAM PLAYING NATIONAL, INTERNATIONAL ROLE

### Evaluation of Alvey

Amsterdam COMPUTABLE in Dutch 18 Jul 86 p 9

[Article: "Alvey's Sequel Still Unclear--Importance of British Program Stressed"]

[Text] London--What exactly the sequel to Alvey, the British data processing stimulation plan, will look like is still unclear. A committee is now investigating the objectives of such a plan and how it could be financed.

The committee is to report to the British minister of information technology, Geoffrey Pattie, before October. By that time the Alvey funds will have been largely spent. One of the main issues in the discussion is finding a balance between national and international research efforts, given the large number of international research programs such as ESPRIT, EUREKA, and RACE and the necessity for British industry to cooperate at European level.

National

"The international dimension is important, but national efforts should definitely be continued to provide British industry with a competitive position, and to maintain it relative to American and Japanese industry," explained the committee chairman, Sir Austin Bide. "It is particularly important to look to Europe wherever standards are concerned." Pattie put an end to doubts that had arisen concerning a next round of government subsidies. "Let me stress my acceptance of government financial support playing a role in promoting cooperative projects and industrial competitiveness," Pattie said at the recent annual Alvey conference. He added, however, that one should not fall into the habit of automatically assuming that subsidies will be available once a program is created. The committee is now looking for ways to stimulate cooperation between consumer and supplier to speed the flow of advanced technology to the consumer. A subcommittee on applications is surveying eight sectors of British industry and government to test "representative and interesting applications with broad user potential." Although the emphasis has now shifted from supplier to consumer, this does not mean that extra money will be pumped into the program. The subcommittee now suggests that another financing method must be found within Alvey for projects such as OSI demonstration, innovation support, and other data processing stimulation projects.

Long-term research will not completely disappear from the agenda, although a research subcommittee is now investigating which fields should receive support, in accordance with Minister Pattie's view that subsidies should be stopped if not indispensable.

## New Partners

Amsterdam COMPUTABLE in Dutch 18 Jul 86 p 2

[Article: "Logica Takes Part in Alvey"]

[Text] Rotterdam--Logica Cambridge and Logica Energy and Industry Systems will cooperate with Shell Research and FBC Ltd. within the framework of the British Alvey data processing stimulation plan. They intend to develop a demonstration system for intelligent knowledge-based systems, the aim being to illustrate the applicability of expert systems to industry. Two expert systems will be built, one in the field of engine lubricants and the other for agricultural chemicals. The systems will help in manufacturing those products. Furthermore, a number of modules will be developed that can be reused in manufacturing. The modules will fall between expert systems and programming languages for artificial intelligence.

## Parallel Simulation Software

Amsterdam COMPUTABLE in Dutch 18 Jul 86 p 3

[Article: "Alvey Project for Parallel Programming--Software for the Transputer"]

[Text] London--Within the framework of Alvey, the British data processing stimulation program, the PARSIFAL (Parallel Simulation Facility) project has been running for a few months. This project deals with the development of software that determines the best connections between the parallel processes of a given program and configures the transputer on that basis.

One of the problems in writing software for parallel computers--quite apart from retraining programmers to make them think in parallel and not in sequential terms--is determining the proper configuration for the processors. According to Clifton Hughes of Logica Cambridge, coordinator of the PARSIFAL project, there are two views on this issue.

One school thinks that it does not really matter how the processors are connected or what their communication overhead is because the transputer is faster than any other chip! The other school thinks that transputer systems become measurably more efficient when the connections between the processors are adapted to the application. PARSIFAL is to find out which view is correct, for which it received a 1.9 million pound [7.2 million florin] subsidy.

### Complex

As part of the evaluation process the participants will develop software to discover what happens with an Occam program (Occam is a programming language

for parallel processing) running on a given configuration. This software investigates the message flow between processors and detects CVE-intensive processes.

Cambridge University supplies applications software for voice and image processing and the FEGS engineering firm supplies a program for finite element analysis. The tests will be carried out with this software.

Unlike the 68000 processor for instance, little is known about the transputer's performances. According to Hughes, the transputer is far more complex than a 68020. The project is also developing special hardware to construct the various transputer configurations. The University of Manchester is constructing a "T-rack" consisting of 64 transputers with a 1-megabyte memory each. This concept--two or more "T-racks" can be linked to multiply performance--resembles the FPS-Module concept (see COMPUTABLE, 11 April, page 5).

The "T-rack" provides a wide range of switching possibilities between the transputers: each transputer can be linked to the other transputers through a switch matrix. Since the switch matrix is programmable, different transputer configurations can be produced.

PARSIFAL's ultimate goal is a program that works from the processes written in the Occam source code to determine the connections between the processes and then configures the transputers on the basis of that.

It will almost certainly take another 3 years or so for the results of PARSIFAL to appear. One of the developments within the project that is somewhat closer to realization and more relevant for commercial applications is the conversion of the Transputer Development System to Unix by Logica.

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WEST EUROPE/ SCIENTIFIC AND INDUSTRIAL POLICY

## EEC RESEARCH EXPENDITURES FOR 1987-91 OUTLINED

Rome IL MESSAGGERO in Italian 25 Jul 86 p 25

[Excerpts] Brussels--The European Commission in Brussels yesterday gave the green light to the long term framework program for scientific and technological research. If everything goes smoothly, a sum of 11.6 billion lire, plus a reserve of 1.74 billion lire, will be spent from 1987 to 1991 to improve the joint efforts of the EEC member states in the area which is regarded as vital if the technological gap which separates Europe from the United States and Japan is to be bridged. However, even when one considers the increasing budgetary difficulties of the EEC, a financial commitment of these dimensions appears to be totally inadequate. But, as the experts tell us, it would not have been possible to achieve anything more without risking government vetoes. Mr Karl Heinz Narjes, the German commissioner for industrial problems, has admitted that the financial crisis represents an uncertainty, and that the European Parliament in Strasbourg will have to make use of the "maneuvering room" granted to it in budgetary matters if the program is to get off the ground in 1987.

The research ministers of the various countries will begin discussions in October, and the presidency (British during the last 6 months of this year) expects to reach a decision by December. However, we must bear in mind that approval of the framework agreement requires a unanimous vote, while approval of specific programs requires only a majority vote. At the Hague summit, the heads of state and government stated once again that "cooperation and technological innovation at Community level will provide an indispensable contribution to the ability of European industry to survive in a world characterized by relentless competition."

On the other hand, there are a number of indications that not all the European partners are that interested in developing research as a community. The FRG provides us with a glaring example of this attitude. This country has no intention of increasing the financial resources of the EEC, fearing that it will be the one to foot the bill, and is doing everything it can to ensure that what money there is goes almost exclusively to agriculture. The current dispute regarding the proposed budget for 1987 confirms this tendency to limit as much as possible the allocation of resources for the strengthening of technological cooperation between the twelve member states.

There are eight main areas in which research should be developed: health care, with particular emphasis on preventive medicine; information technologies, an area on which the competitiveness of two-thirds of the economy depends; telecommunications; the introduction of new technologies into industry; nuclear energy; biotechnolgy; the exploitation and utilization of marine resources and, finally, "the Europe of researchers," i.e., the promotion of exchanges between the community of scientists in Europe and the training of personnel involved in all areas of science.

8616
CSO: 3698/M222

WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

# PARTICIPATION OF NON-EEC COUNTRIES IN ESPRIT CONSIDERED

Amsterdam COMPUTABLE in Dutch 6 Jun 86 p 9

[Article: "Participation of EFTA Countries in ESPRIT Considered: Tripling of Budget Proposed"]

[Text] Brussels--The European Community is considering the admission of non-members to ESPRIT's second phase, which focuses particularly on factory automation and chip technology. The EC wants to triple the budget for this phase.

Officials in Brussels are thinking seriously about allowing non-EEC countries to join the second phase of ESPRIT, the program to stimulate data processing technology. Especially countries from the European Free Trade Association (EFTA) such as Switzerland, Austria, and the Scandinavian countries are being considered. One of these officials described the possibility to COMPUTABLE as "not unattractive as a way to increase still further the competitive position (of Europe - editor)."

## Design Costs

The EC's consideration is based, inter alia, on market research reports forecasting a decrease in the share held by European suppliers of data processing products in their own market during the next 5 years if policy remains unchanged. This is the case in spite of the fact that Europe, representing 30 percent of the world market, is expected to become the largest market for these products.

To counter this drop in its own industry's market share, the European Commission wants to raise the stimulative funds in ESPRIT phase 2 to three times that in ESPRIT phase 1. This comes to more than 4.5 billion guilders for the 4 years starting in 1987. The principal aim is to give financial support to projects directed toward the design and mnaufacture of advanced integrated circuits, factory automation and robotics, and office automation.

Among the goals is to greatly reduce design time and costs for these products. Thus, there is talk of 4-megabyte custom chips being developed "within a few weeks" and of the development of "technologies and tools allowing system design at one-tenth of the current costs." One goal is to increase "the share of suppliers of data processing products to a dominant position in their home market" in the field of factory automation; another goal is to acquire a "substantial share" in the remaining world markets.

25026/12859
CSO: 3698/A167

WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

## REDUCED FUNDING GRANTED FOR EEC'S COMETT PLAN

Amsterdam COMPUTABLE in Dutch 20 Jun 86 p 24

[Article: "Education Ministers Approve Reduced COMETT Plan"]

[Text] Luxembourg--The ministers of education of the European Community have agreed upon a reduced version of the COMETT plan. Instead of the request for over 150 million florins, a sum of 110 million florins has now been allocated for the promotion of cooperation between industry and the academic world.

Italy, Belgium, Denmark, Luxembourg, the Netherlands, and Portugal were willing to come up with the over 150 million florins requested by the European Commission. Opposition from other member states, especially the FRG, finally led to the reduced amount of 110 million florins.

The COMETT plan aims to promote cooperation between industry and the academic world in the field of modern technology. To that end a European training collaboration network will be set up for student training courses, student exchanges, technical cooperation, exchanges of lecturers, etc.

In 1985 most member states agreed upon the plan in record time. Only the FRG seemed to oppose the form that was chosen. Federal Minister G. Stoltenberg wanted to reduce the initial amount of the grant by several tens of millions. The fact that agreement was reached in spite of this was due to Stoltenberg's early departure from the discussion.

Apart from the financial aspects, it has also been decided that the European Commission will report on COMETT to the ministers, the European Parliament, and the Economic and Social Committee before 31 October 1988. Before 31 October 1989 the ministers of education will have to make a decision on a proposal to proceed with the plan, and the Education Council will have to express its opinion about the agreed amount of 110 million florins before 31 December 1988.

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

## EUROPEAN PRESS SKEPTICAL OF EUREKA PROJECT

Paris ZERO UN INFORMATIQUE in French 16 Jun 86 p 7

[Article by Philippe Moins: "France Ahead in Europe...on Paper: Review of Press Coverage of EUREKA"; first paragraph is ZERO UN INFORMATIQUE introduction]

[Text] Commentaries on the EUREKA project almost everywhere in the European press demonstrates that so far nothing has been won.

The Institute of the Future, an organization which "watches the changes that create the future," has gone through the newspapers and magazines of the various European countries with a fine-toothed comb examining the attitude toward the European EUREKA project over the past months.

The typical press analysis reveals neither overwhelming enthusiasm nor categorical rejection, but a generally poor understanding of EUREKA's objectives. Even in France, where the project's importance is well known and well covered in the press, it seems that EUREKA is still being seen as a response to the American Strategic Defense Initiative (also called "Star Wars").

It would be more exact to trace the project's origins to the 1982 Versailles summit which created the "Technology-Growth-Employment" group. Born on 23 March 1983, SDI is thus younger than EUREKA.

Another frequent mistake: EUREKA is not the exclusively civil project which the press tends to contrast with SDI. "EUREKA has a military dimension written between the lines," says the Institute of the Future. Another error has involved press analysis of the role and hesitations of the FRG.

### Of the 70 Leading Industrial Partners in France 25 Are Small- or Medium-Sized Companies

In the FRG, on the contrary, media coverage seems to have been much more modest thus far and the tone of the articles has been much more critical than in France. The criticism focuses on insufficient financing and the awkward collaboration among 18 governments. To this we have to add the skepticism of public opinion and most of the representatives of economic life. The absence of concrete content, competition with other projects such

RACE [R&D in Advanced Communications Technologies for Europe] and ESPRIT [European Strategic Program for R&D in the Information Technologies], implicit preference for large companies...in their opinion these are the principal problems with EUREKA.

However, if there were a prize for silence, it would be awarded without contest to the UK, where the press has remained virtually silent on the subject. The British as a whole do not believe that EUREKA can play a very important role because, we read in the press, "this name refers to something that could have been born spontaneously from private initiatives."

Faced with such objections, the representatives of the European project had to provide some clarification. Michel Aubert, deputy to Yves Sillard (Mister EUREKA for France), reemphasized that "SDI and EUREKA do not have anything to do with each other, especially in terms of financing where the former provides 100-percent government support, which is not at all the case with EUREKA." Moreover, the question of EUREKA duplicating ESPRIT projects is in reality a false problem. On the contrary, affirms Michel Aubert, the complementarity between the two is obvious: "ESPRIT is of a precompetitive nature whereas EUREKA belongs to the competitive field."

Why then is there so much misunderstanding or misinterpretation by the public? Michel Aubert does not hide the fact that there is a real information shortage at the moment.

In any case, we will know more on 30 June 1986 when a dozen new industrial projects in which the Germans are taking part will be presented. So far the FRG has shown little enthusiasm and German initiatives can be counted on the fingers of one hand, whereas, on the French side, the 80 candidate projects counted last October now amount to 110. "One hundred ten projects, that means 70 leading industrial partners, because it is not unusual for the same firm to head 2 or 3 projects. And, of these 70, no fewer than 25 are small- or medium-sized--not an insignificant fact. Thus, an appointment has been made for 30 June 1986 when the details of the new projects will be known.

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

## FRENCH PREMIER ON DATA PROCESSING INDUSTRY, STRATEGY

Paris ZERO UN INFORMATIQUE MAGAZINE (supplement) in French May 86 pp 23-24

[Interview with French Prime Minister Jacques Chirac; date and place not given. Text begins with publisher's excerpts]

[Text] The data processing industry is a "vital" and "strategic" sector; No software industry program is planned; Bull will be privatized "rationally;" Government contracts to be opened to greater competition; Our industry must adapt Minitel to foreign markets; More work is needed on the "Computers For All" program; Without components, there is no independence.

[ZERO UN INFORMATIQUE] General de Gaulle, in providing France with the first "Plan Calcul" 20 years ago, saw data processing as one of the strategic hubs of French industry. In 1986, where would you place data processing among the various branches of a great nation's industry?

[Jacques Chirac] There is little meaning in trying to compare the branches of industry. However, I can tell you that within the components, professional and military electronics, and telecommunications sectors, data processing in all its forms (management information systems, scientific and industrial data processing, and automation) will continue to hold a central position.

Beyond its own economic weight, this sector is vital to the development of a nation like ours. It is the source of improvement in the ability of all industries and the services sector to compete.

It is strategic to both the military and civilian worlds.

[Question] Up to now, we have placed the greatest importance on the manufacture of computers and related hardware by French industry. Do you not think that France's software industry, which is said to rank second internationally, should receive greater attention from the public authorities? Why not have a French software program?

[Answer] A development program is necessary, even in an advanced field if it is strategic for France, if French industry is weak in it, and if

international competition is skewed by a foreign government's aid to its own industry, This was true of the computer industry and the "Plan Calcul;" this is true of micro-electronics and the successive components programs.

I do not believe that the French software industry, which is second in the world, needs a broad, structured plan, and the constraints it would impose, in order to develop. I do not believe that the profession has asked for such a program.

This does not mean that the software industry is being neglected. There are governmental agencies (in particular, within the ministry of industry, posts and telecommunications, and tourism, as you well know) that are working to create conditions favorable to its development. Moreover, it profits from the spinoff of other development programs in the electronics and computer industry and it participates in the European programs ESPRIT [European Strategic Program for Research in Information Technology] and EUREKA [European Research Coordination Agency], a competitive environment in which it has yet again proven its dynamism.

[Question] At present, the state is Bull's main shareholder, but France's company is on your new government's list of those to be returned to the private sector: How much of it and how soon? Also, do you think that investors will be interested in a company that will not turn a profit without state help? If you, yourself, were investing, would you not prefer IBM shares to Bull?

[Answer] Privatization is a complex process that will be carried out with all the calm and lucidity it requires. We are not at the authorization stage. You will readily understand why I cannot answer your question at present on the details of the operation concerning Bull.

[Question] Aside from subsidies or shareholding, Bull (or CII or CII-HB) has always received indirect aid from the state, either official aid (purchasing commitments from government entities between 1977 and 1981) or more or less tacit aid.

Should this policy be continued, even if Bull becomes totally private, or should full freedom of choice in a competitive market be restored to public institutions?

[Answer] I do not think that the phrasing you have used is appropriate. Public institutions in France, as in any country, have their procurement policy which must take into account the needs of the user and the constraints of industrial policy. For several years, this procurement policy has been moving toward a greater openess to competition and this trend will be broadened because it is stimulating to all. This will be done in cooperation with all the producers concerned. At the same time, the role of the various participating agencies will be redefined.

[Question] Does the development of a data processing industry seem to you an essential factor in the development of a country's economy in 1986?

[Answer] As I said in answering your first question, the development of the data processing industry is a very important factor in the development of the entire economy. Look around you and you will see that all gains in productivity, every improvement in competitive standing are due to computer science. An industry that does not computerize is destined to perish. This is true not only for the large conglomerates; it is also true for small and mid-sized businesses in which we are seeing microprocessors increasingly used.

Having said that, the technology has evolved. It is no longer enough to develop the data processing industry alone: In order for an economy to continue to develop with international competition, it must have a dynamic electronics sector and it must have a telecommunications network and services suited to its needs.

[Question] France is the only country in the world to have undertaken a project as original as developing the Minitel and distributing specialized terminals to a large segment of the population. Could this be a dead end like the 815-line television screen or the Secam broadcasting system?

[Answer] It is true that France is ahead of all other countries in videotex services and that this development has possible thanks to the wide distribution of Minitel terminals and the performance of our telecommunications network. Services based on this mode of communication seem to be developing rapidly now, in healthy competitive conditions. The overall economy of the support network is healthy. I do not see how we could be heading into a dead end. The telecommunications administration is already thinking about future versions of the Minitel capable of memory and interaction.

It remains that the technical norms and standards with regard to terminals vary from one country to the next and that to profit by exporting what has been a success in France, our industry will have to know how to adapt its hardware, to make it more versatile and suited to the needs of a diverse clientele. This is true in many other sectors. And it is not insurmountable.

[Question] Last summer, your predecessor launched the "Computers For All" program in grade schools and high schools. Do you wish to pursue the program as it now stands?

[Answer] At the technical level, the "Computers For All" program is proceeding as planned. But the problem that now arises lies in the use of the tools we have installed. We must develop the pedagogical aspects, learn to master the computer more fully, develop the appropriate educational software, extend access to the computers to the entire education system. As you can see, there is still work to be done in order to achieve a lasting educational success with the program.

[Question] Information carries the risk of violating freedoms, a point you, yourself, underscored in an interview with us in 1984. Hasn't this problem been overshadowed in 1986, at a time of insecurity and terrorism?

[Answer] Dealing with the questions relating to insecurity and terrorism--a priority, as you know, in the government's view--should in no way result in a reconsideration of the fundamental guarantees offered to every citizen in this country, in particular the protection of person and privacy against the dangers that would arise, if we were not careful, with the uncontrolled growth of files and information systems.

[Question] Computerization is widening the gap between industrial nations and developing nations. What are your thoughts on this problem?

[Answer] I am not convinced that computerization is widening the gap between nations. Look at how countries that were still referred to as "developing" a short while ago--I am thinking of the Far East or the larger Latin American countries--were able to use all the tools of computer science to build a productive industry.

Furthermore, we are seeing inexpensive microprocessors arrive on the marketplace, which can be bought in countries where funds are scarce.

[Question] Your predecessors pursued an active policy in favor of the data processing industry (French control of Bull, the electronics sector, the "Computers For All" program). Do you hope to provide a new impetus in a more ambitious program or are you content to continue what has been started?

[Answer] The active policy pursued for 20 years is precisely what led to the birth of a French computer industry. It now has to stay in the race of international competition. As long as our companies' competitors are aided by their governments--Pentagon contracts in the United States, the fifth generation computer program in Japan--France certainly cannot be an exception to the rule. But that is not the central question. Support must not consist only of financial aid, be it for research and development. The idea is not so much to do more, but to do things differently.

To create an environment favorable to the development of our data processing companies, the entire electronics industry must first be developed--components, first and foremost, without which we cannot be independent. Next, the relationship between public and private research must be strengthened through the development of cooperative research and the training of this industry's main resource--its men. The standardization effort must then be intensified to arrive at compatibility of hardware by competition. Finally, there should be international cooperative ventures that have been well thought out.

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

## FRENCH ELECTRONICS SECTOR MOVES TO MINISTRY OF INDUSTRY

Paris ZERO UN INFORMATIQUE in French 5 May 86 p 7

[Text] Playing both sides of the net, both client and supplier, the PTT [Postal and Telecommunications Administration] had to have the boundaries of its activities adjusted sooner or later. The secretary of state for posts and telecommunications, Gerard Longuet, has devoted his time since being appointed to Jacques Chirac's government to condemning the "unusual tapping" of the PTT budget for the sole purpose of funding the electronics sector.

Overseen by the PTT ministry since 1983, the sector is once again under the wing of the ministry of industry. It was so decided in a decree published in the government gazette of 26 April: "Gerard Longuet assists the minister of industry, posts and telecommunications, and tourism in the excution of the minister's responsibilities relating to the administration of Posts and Telecommunications, with the exception of his industry responsibilities relating to the electronics, computer, space and telecommunications sectors."

Gerard Longuet will also retain oversight of the public telebroadcasting entity, TDF.

He is now free of a heavy financial burden that rose from 400 million francs in 1983 to 3.4 billion in 1984, 6.5 billion in 1985 and 6 billion in 1986. These are the sums that were taken from the PTT budget in order to provide for the electronics sector. Moreover, there are the grants made to the CNES [National Center for Space Studies] and the "Computers For All" program. All appropriations combined, the budget drain had considerably broadened, from 2.8 billion in 1982 to 20 billion in 1986. At a time when the idea of deregulation is gaining ground, the situation has been restored to order for the Postal and Telecommunications Administration.

Finally, with regard to the agencies that have been established, the DAII (Directorate for International and Industrial Affairs), which oversees the computer and office automation sectors, will leave the PTT in all likelihood to be brought closer to the DIELI (Directorate of Electronics, heading up components and consumer and professional electronics) under the ministry of industry.

Alain Madelin [minister of industry] now has the ball in his court.

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

## ITALIAN DEFENSE MINISTRY-CNR RESEARCH RELATIONSHIP CRITICIZED

Rome LA REPUBBLICA in Italian 27 Jul 86 p 6

[Article by Alessandro Figa Talamanca: "The National Research Council Has Never Heard of Dr Strangelove"]

[Excerpts] In the crowded panorama of Italian politics, the fact that a framework agreement between the Defense Ministry and the National Research Council [CNR] has been finalized certainly does not seem likely to make the headlines. All the more so since the agreement is so general that it is impossible even to understand what its objective is. Maybe it is merely one of those innumerable initiatives aimed at creating an image for the CNR as an organization which is active in all sectors of the nation's life, and which is also aimed at bringing in funds. But if this were the case, then this agreement would not even be worth mentioning.

There is something disturbing buried deep inside the "vacuum" of this ostensibly pointless agreement. It is believed that for the first time since the end of World War II, the CNR may intend to carry out research work covered by military secrecy.

The first draft agreement, which was rejected by the Executive Council (the management unit of the CNR), contained an all encompassing clause which read as follows: "The CNR hereby undertakes not to divulge the results of studies or research conducted in agreement with the Ministry of Defense as part of the present agreement, nor to divulge any information or data to which it may have access as a result of this collaboration should the Ministry of Defense deem this necessary for reasons of security." A less general formulation is presently being worked out by the Minister for Research.

First, let us try to understand what the use of military secrecy is. Certainly, in the wording of the relevant clause in the agreement between the CNR and the Ministry of Defense, its use is not to protect military programs from a hypothetical enemy. The main use of secrecy is to cover up the "vacuum" or, in other words, to provide a license to carry out research which either is nonexistent or of minimal importance, and to make payments to organizations or individuals whose names can remain undisclosed.

In short, secrecy is used to ensure that research is not subject to effective checks, and that financing is not subject to administrative controls.

The CNR will not develop secret weapons in its laboratories, nor is there a hysterical Dr Strangelove concealed within the ranks of CNR researchers. No, the danger lies elsewhere. As Vittorio Zucconi explains so succinctly in his correspondence from Washington, the Strategic Defense Initiative (SDI)--which already has been given the suggestive nickname of "Star Wars" by its opponents--is seen as a neat little pile of dollars to be distributed to industry and research laboratories.

Some of this money will reach Italy as well. One could maintain that there is nothing wrong with industry and the scientific community in Italy becoming involved in high tech programs. One could also maintain that SDI research brings the world one step closer to global disarmament and to peace.

But what is worrisome about all this is that what will actually happen is that the money allocated to SDI will be used as secret funding for parties and splinter groups, with the result that government and parliamentary freedom of action in important aspects of foreign policy will be undermined. What all citizens--whatever their political affiliations--should demand is that the choices regarding the role that Italy will play in the Strategic Defense Initiative be made in broad daylight, and that every cent allocated to research be accounted for.

What scientists should demand is that secrecy should be abolished from all areas of activity of the public research structures, and that a clause similar to the one included in the contracts made by the U.S. Army and universities be adopted as a standard clause for all agreements or undertakings concerning these structures.

But why is it that the CNR, the highest representative of the scientific community in Italy, did not simply reject all secrecy clauses out of hand, preferring instead the slippery path of compromise? It would have been easy to make a hard and fast stand. According to its statute, approved very soon after World War II, the CNR "promotes, coordinates and regulates scientific research for the purposes of scientific and technical progress."

What, then, has military secrecy to do with activities that are sanctioned by a legal statute?

But recent legislation--called for, paradoxically enough, by the left--sets the stage for a CNR which has severed its links with the scientific community. In the "new version" of the CNR or, in other words, a CNR freed from the constraints of a law which, as it happens, dates back to the liberation of Italy, a place will also be found for military secrecy. In fact, it is a miracle that the present Executive Council, whose term of office ran out and was extended, did as much as it did in making a timid display of resistance.

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

## FIAT PLANS RESEARCH, TECHNOLOGY CENTERS FOR SOUTHERN ITALY

Florence LA NAZIONE in Italian 2 Aug 86 p 8

[Text] Turin -- A commitment of 2.6 trillion lire, of which 2 trillion is destined for investments for the application of new technologies in Fiat Group plants in the "Mezzogiorno" (southern Italy), and another 600 billion lire for the establishment of six scientific and technological centers and for the development of research centers -- these are the most significant points of the program that Fiat plans for southern Italy in the 3-year period, 1986-1988, as presented by Cesare Romiti, managing director of the Turin company, to Salverino De Vito, the minister for the Fund for the South.

A Fiat communique states that the program's initiatives will involve intense professional training of over 1,000 high school and college educated researchers, as well as retraining of 3,500 employees in the south. According to the communique, this program can be regarded as the first significant example of "programmed negotiation," a new instrument developed by Minister De Vito to involve large industrial groups in the realization of the "3-year program" for the rebalancing of technology and production in southern Italy.

The communique adds that the compensation for the firms is based primarily on the creation of a preferential method for granting incentives with the adoption of special procedures.

The program presented by Romiti, in addition to being technologically and economically relevant, is characterized by the widespread use of advanced data processing systems, the integration of production investment and research, liaison with large domestic and international projects, and by close and systematic cooperation with research centers in southern Italy.

At the conclusion of the program, the Fiat communique continues, about three percent of Fiat's southern Italy employees will be assigned to research, thus bringing the proportion close to that which exists in the company's organization in northern Italy.

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WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

## BRIEFS

EIGHT NEW BRITE PROJECTS ANNOUNCED--Brussels--The committee responsible for supervising the BRITE project has been able to subsidize additional projects with the available financing. By aiming exclusively at the first round of financing of the proposed "Basic Research in Industrial Technologies for Europe" (BRITE) projects, the supervisory committee has managed to subsidize more projects with the money available for the first round (over 150 million florins). The grant per project has decreased considerably because subsequent phases no longer qualify for such grants. Eight new projects have been subsidized in this way, among others the development of cheap CAD workstations by Prima Industrie (Italy), Eurosoft (France), and Eria (Spain); these will be used for the calculation of tool paths for a welding/cutting robot. Ferranti Industrial Electronics and the British Welding Institute will jointly develop a flexible laser robot for welding steel plates, while ICI (Great Britain), UCO and Centexbel (Belgium), and Mahlo (FRG) will develop a process control system. In addition, the second round of projects will soon take off. In early 1987 the committee will call for the submission of proposals for new projects before the end of March 1987. From the initial budget of 125 million ECU's (approximately 300 million florins) the sum of 60 million ECU's (145 million florins) still remains. [Text] [Amsterdam COMPUTABLE in Dutch 27 Jun 86 p 11] 25046/12859

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WEST EUROPE/TECHNOLOGY TRANSFER

# INDUSTRIAL ESPIONAGE INCREASING IN DENMARK, EASTWARD

## Yugoslavian Case

Copenhagen BERLINGSKE TIDENDE in Danish 6 Jun 86 Sec III p 7

[Article by Thomas Larsen: "Espionage in Practice"]

[Text] It is not talked about. But everyone says that industrial espionage is growing. Both away from and at home.

Managing Director Stanny F. Kilde marketed for a couple of years at a major fair in Hannover a series of three or four machines for press-formed wood. They were exported to several countries in Europe. Among the customers was a large State company in Yugoslavia.

A half year ago the Skive director was telephoned by a German business connection who had received quotations for some new machines for press-formed wood. They were hardly distinguishable from those the director sold.

"My German business connection sent quotations and brochures to Denmark. We could see that the Yugoslav firm had directly copied our machines," Stanny F. Kilde says today.

He telexed the Yugoslav company, which will remain anonymous, several times. In reply he received, among other things, a letter from a Yugoslav factory whose name he had never heard of! Today the case is entering its second month at the Yugoslav embassy.

"There are no rules of ethics in East Bloc markets," Stanny F. Kilde says today. "And at the same time we did not have the design registered or have a patent taken out on our machines. We are certainly not sufficiently attentive to this problem here at home. If a product has been put on the market just once a patent can not be taken out."

### Fellow Worker Leaked

The Jeros A/S machine works is on Funen. In 1985 the firm won a lawsuit against a former employee--and the Ceolein Aps firm. The case concerned the copying of dishwashers for industrial use.

"We won the lawsuit not only because they had made an imitation," Jeros A/S Managing Director J.R. Kristiansen says. "At the same time they had used one of our former employees in a position where he had access to our dealers and our drawings."

Along the way Jeros A/S got an injunction against the competitor's machine: "But as soon as it expires they can continue selling. For a small sum Ceolein got a product which has cost years of experience and millions of kroner to develop," the Jeros A/S director says.

"With the injunction we put a million aside for a year and a half. Today we meet Ceolein at shows with our machine," J.R. Kristiansen says. "We feel cheated."

"Some good advice? It is necessary to protect one's product as rapidly as possible. If irregularities are discovered it is necessary to investigate immediately what is wrong. Too many firms are losing know-how which they have spent years developing."

"Industrial espionage is destroying our business. First the others are saving millions of kroner on the development side and then we have to compete hard with respect to prices."

An Unusual Nighttime Break-In

Labotek A/S in Frederikssund has had several thefts: Money from the canteen and cigarettes were the thieves' haul. Perhaps. One nighttime break-in made the management view the operation differently: "They broke open the locked file cabinets in the personnel department," Labotek Financial Head Lola Anderson relates. "At the same time there was direct access to the drafting room, which was freely accessible at that time."

/How/ [in italics] much disappeared is not known today. Apparently no papers had been stolen. But on the other hand the copying machine which stood outside could have been used:

"It has come as a complete surprise that this has happened. Previously we assumed it was boys who broke into the firm. But it does not have to be: It could have been a cover," the financial head says.

Today the development department has been protected. At the same time security equipment, burglary alarms and access control systems are being installed so that the entire firm will be protected.

## Swedish Security Model Studied

Copenhagen BERLINGSKE TIDENDE in Danish 6 Jun 86 Sec III p 7

[Article by Thomas Larsen: "Industry Council Looks at Swedish Security Model"]

[Text] The Danish Industry Council advises regarding industrial espionage only when requested. Now the adoption of a Swedish idea is being contemplated.

The Industry Council has no obligation to prevent theft or espionage among the country's firms.

This is what Jørgen Stein, the head of the Industry Council's planning department, says: "The Industry Council advises firms only if they themselves approach it. The organization's consultants can, for a fee, go out and investigate firms."

General Guidelines

Now, however, the Industry Council has begun studies of its sister organizations in Norway and Sweden. The Industry Council will possibly be changed in the direction of the Swedish model.

There the Industry Council established an association which advises and supports firms in questions concerning industrial espionage. "For the moment we are investigating whether we can do something equivalent here at home," Jørgen Stein says.

"But this is not necessarily the right solution; an association can at the same time be an aid to industrial spies. It is dangerous to make general guidelines concerning industrial espionage."

The State's Role

Regarding Swedish laws concerning industrial espionage, Jørgen Stein says: "The body of laws we have here at home is all-embracing. It is a problem that it is a question of so many different laws--but combined they cover the same areas as the Swedish legislation."

Jørgen Stein thinks that we in Denmark have a professional reserve which can cope with those situations which can arise. "The question is also whether it should be a State duty to protect against industrial theft."

## Industries Hurt by East Espionage

Copenhagen BERLINGSKE TIDENDE in Danish 13 Jun 86 Sec III p 6

[Article by Thomas Larsen: "East Bloc Espionage Against Danish Industry"]

[Text] When the Soviet Union's intelligence services want to have information on Danish firms, a large apparatus is set in motion. The methods are many. From the recruiting of fellow workers to advanced electronic monitoring, security field experts says.

One evening the head of a firm was visited by two Russian engineers. They came with gifts for his children and knew his wife's name. The engineers

explained in broken Danish that they would like to place a large order for the Dane's products--advanced measuring instruments.

The firm head went to the Police Intelligence Service (PET), which in return was able to show file photographs of the "engineers."

The firm head will remain anonymous here. With exports to the USA, the publicity would hurt his business drastically.

"If a firm is competing with an East Bloc country, it can come to be confronted with an intelligence service. If the firm is developing a product which is of interest, it is a target," concludes Director Peter Kristiansen of Spectronic, a firm in the security field.

Touring of the field produces commentaries with the same content. A subject which is immediately closer to spy novels than reality becomes concrete.

Vice-Director Defects

/Something/ [in italics] is known about East Bloc intelligence services. At PET they refer to a vice-director of the Romanian intelligence service who defected to the West a few years ago. His job was industrial espionage against Western firms--and he has since told about this in detail.

The espionage business is considerable: The Soviet Union spends 15 billion kroner on stealing Western technology; each Soviet agent gives back sums in the hundreds of millions; the Soviet Union has had 30,000 wishes for advanced electronics fulfilled via espionage. These are some of the "facts" which are often used.

How they were arrived at no answer is to be gotten for.

On the other hand, intelligence agents have been indentified in connection with East Bloc embassies: "From various cases we have a reasonable basis for estimating Eastern espionage," says Arthur Mønsted, ex-intelligence-officer and today director of a firm in the security field.

It is typically advanced electronic equipment which East Bloc countries are interested in, Arthur Mønsted says--other targets are the medicine industry, firms which specialize in biotechnology, and the energy sector. The development fields as a whole are in the risk area, security field experts says.

Go After the Employees

There have been cases in which expensive and highly developed eavesdropping equipment has been used. But /human/ [in italics] weaknesses are concentrated on most, Arthur Mønsted says.

The recruitment of suitable industrial spies is divided into various stages. First comes broad talent scouting. Then contact with the firm, which can take place through social gatherings. Or a person is found who has a

third-party relationship with the firm. If it is a question of longterm planning, a man is placed in the firm over a number of years.

Other methods are friendships and/or information which compromise: "First the victim is asked for ordinary things; for example, prospectuses and data sheets," Arthur Mønsted says. Materials which could just as well be gotten via a telephone call to the firm. But gradually the demands are heightened and the victim slowly moves into a gray area between the innocent and the intelligence-related. Until the trap snaps closed.

Arthur Mønsted has knowledge of an example in which a fellow worker received a /receipt/ [in italics] for well-done but innocent work. All the same the receipt was able to be used perfectly as pressure against the fellow worker.

Another, rarer, variant is decidedly illegal activity. Here the fellow worker is security-briefed by his officer. He receives instructions to be careful. Contact is not made with each other by telephone, and they meet abroad.

"We have examples of both methods here at home," the ex-intelligence-officer says.

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CSO: 3698/657

WEST EUROPE/TECHNOLOGY TRANSFER

## BRIEFS

DENMARK: 20 MILLION TO EUREKA--The government wants to stimulate interest in the EUREKA European joint research effort, and Industry Minister Nils Wilhjelm (Conservative Party) has for this reason requested from the Folketing Finance Committee 20 million kroner a year, for the time being, for Danish participation. The government is prepared to provide additional support should it be needed. Also, it is to be investigated how funds can be procured from the private sector for the joint effort, which aims at increasing European industry's competitiveness, especially in the high-technology field. Up to now about 100 ideas for projects have appeared, including four concrete Danish project proposals. [Text] [Copenhagen BERLINGSKE TIDENDE in Danish 12 Aug 86 Sec I p 6] 8831

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EAST EUROPE/BIOTECHNOLOGY

# LONG-TERM DEVELOPMENT OF BIOTECHNOLOGY IN CSSR

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[Text] Introduction

The Main Objectives for the Economic and Social Development of the CSSR for 1986-1990 and the Outlook for the Year 2000, which was approved by the 17th CPCZ Congress, establishes that, as part of the basic objectives of R&D as a critical factor in economic intensification, basic science, research and development will be concentrated on the development of biotechnologies, fermentational and microbiological products, and their utilization in the agro-food complex and the health care sector. This task is fully in line with objective trends in the evolution of R&D. It is therefore also assumed that the development of biotechnologies and their extensive application will represent one of the critical areas of scientific and technical progress which will significantly influence future socio-economic development.

Biotechnologies are defined as a set of production techniques based on the exploitation of substance transformations, their constituent mechanisms, and other phenomena of all types and categories of living systems. Generally speaking, biotechnologies are regarded as one of the most important sources of innovation for national economic development, whose main impact may be expected at the end of this century and the beginning of the next. Biotechnological processes involve, basically, the application of radically new findings, technical and methodological approaches based mainly on the development of molecular biology and genetics, microbiology, physiology, biochemistry, system and process engineering in a number of economic sectors, but primarily agriculture, the food industry, the health care and pharmaceutical industry, ecology, the chemical industry, as well as general engineering and the electrotechnology. This is why biotechnology is described as an integrated field that is still being developed.

The development of biotechnologies promises to yield significant economic results comparable in many areas to the development of microelectronics and optical electronics. At the same time the comprehensive use of biotechnologies will lead to other important national economic advantages. The most important of these are potential improvements in the food supply, introduction of new energy resources, and improvements in the environment. The contributions of biotechnologies in these areas have, to a certain extent, much greater potential importance than those of the currently best known and operational areas in technology.

In the CSSR increased attention began to be paid to the development of biotechnologies at the end of the 1970s and the early 1980s. This involved mainly tasks related to the biochemicalization and chemicalization of livestock production, where CSSR's research is relatively advanced and where it was possible to draw upon positive results achieved in the agro-food complex. The rapid worldwide development of biotechnologies and the necessity for getting up to speed in the main worldwide developmental trends motivated a decision to replace individual programs and measures with a single programmatic document that could serve as the basis for the purposeful management of the biotechnology development in the CSSR.

Under the supervision of the State Commission for R&D and Investment Development [SKVTIR], a broad groupd of leading experts was organized, which drafted a comprehensive document on the development of biotechnologies. After discussion, the CSSR Government adopted the Long-Term Comprehensive Scientific and Technical Program for the Development and Implementation of Biotechnologies in the CSSR, [Long-term comprehensive program] and the related Resolution No 257/1985. Almost 60 specific tasks have been adopted in this program that are related to resolutions on both research and application. The program also formulated the basic precondition for active participation of Czechoslovak organizations in the fifth priority program of the Comprehensive Program of R&D Progress for CEMA Member Countries Through the Year 2000. This program makes it possible for the Czechoslovak R&D base to participate in the resolution of tasks and to use the results of other projects for which it does not have facilities. The important results of the international division of labor in the development and use of biotechnologies have formed the basis for extensive application of this promising field of industry. The direct participation of the Czechoslovak program in the priority program of the Comprehensive Program for Scientific and Technical Progress for CEMA Member Countries through the Year 2000 is the most basic guarantee that the Czechoslovak program and its goals will be handled with great efficiency using state-of-the-art knowledge.

General Description--Overall Program Objectives

The Long-Term Comprehensive Scientific and Technical Program for the Development and Implementation of Biotechnologies in the CSSR is divided into the following six areas:

a) The application of selected biotechnologies to livestock production. This program depends on the development and application of biochemicalization and chemicalization of livestock production. As has been mentioned, tasks in this area already have something of a tradition in our country, since they have been linked to the implementation of a state priority program for research, development and production of chemical and biochemical products. The primary objective of programs conducted in this area is to achieve greater efficiency in meat production, both by taking better care of highly productive animal populations and by making fodder consumption more efficient.

b) The development of a microbiology industry. This industry is being set up to meet requirements for the development of biotechnologies in agriculture, the food industry, the health care sector and pharmaceuticals, the chemical industry and industry related to the environment. This microbiology industry basically represents a link between basic and applied research. This production capacity cannot be provided without dealing with other tasks such as cultivating microorganisms, testing new biotechnology techniques, etc. These production units should make it possible to verify the results of domestic and foreign research. In other words, this is essential for ensuring effective research in some critical areas of biotechnology.

c) The application of biologically active substances and tissue cultures. Tissue cultures encompass all the technologies that make possible the cultivation of cells, tissues and organs of multi-cell organisms under in vitro conditions not only for conducting research but also for producing biologically active substances and using plant explants in agriculture. The objective of developing the technology of livestock tissue cultures at a state-of-the-art level is to lay the foundation, among other things, for starting production of monoclonal antibodies.

d) The application of biotechnologies in agriculture, primarily in plant production. The basis of this program is to introduce high-yield explant cultures for selected agricultural crops which will facilitate cultivation and increase the efficiency of plant production. A component of this program is to achieve higher levels of symbiotic fixation of atmospheric nitrogen, and to begin production of humus concentrate and biological pesticides, as well as testing and initial production of bioenergy systems.

e) Developing production capability and application for enzymes. This will make it possible to utilize the highly specific catalytic actions of these substances. This will find broad application not only in food production, but also in the consumer goods industry, the chemical industry, medical diagnostics, etc. Most of our attention should focus on developing practical applications for enzymes and the production of enzyme preparations so that we can gradually reduce our dependence on imports. This program also projects the production of seven enzyme preparations by 1995, with others to be mastered by the year 2000.

f) The application of developing biotechnologies in processing industries. This applies to certain basic products of the food industry such as beer, vinegar,

spirits, starches, etc. It is also assumed that modern biotechnologies will be gradually incorporated into all basic food technologies, which will make it possible to optimize or substantially increase the efficiency of Czechoslovak food production. This is also the objective of innovative and modernizing programs in the fermented food sectors. The program for the development and application of biotechnologies and related biological processes in the Czechoslovak economy is directly related to development of certain important tasks in basic and applied research. At the same time the program is considered open to a certain extent, i.e., at some later date it may include other tasks in accordance with levels of knowledge, preparedness, importance, and, last but not least, in conjunction with economic potential, primarily in the area of capital investment and other resources (such as bioelectronics, and increasing the effectiveness of assimilation processes).

The implementation of the Long-Term Comprehensive Program will be influenced to a large extent by progress in tasks of the Comprehensive Program of Scientific and Technical Progress for CEMA Member Countries. Effective coordination of ongoing projects will be especially important for:

--genetic manipulation (cell and genetic engineering, including the chemical synthesis of genes and their products) that will make possible the rational control, programming and development of living systems and their functioning components for processing, production, and servicing activities;

--immobilization of living systems (enzymes, cells and their organelles) that will make possible increased efficiency and stability of their production and processing;

--application of a set of techniques and principles that will optimize conditions for cultivation of cell-producers (microorganisms, plants and animals) and application to production;

--development of effective techniques and methods for packaging, cleaning and storing products;

--introducing principles of process engineering, whose application will help to optimize and automate biological processes.

The Long-Term Comprehensive Program is conceptually based on a thorough integration of all phases of the innovation cycle. This includes tasks of basic and applied research, as well as tasks that facilitate individual investment projects while taking into account energy, material and foreign currency constraints. This means that the gradual implementation of the program will lead to a basic research and production structure for the development and application of biotechnologies in Czechoslovakia that will place this sector among the most promising in terms of R&D potential.

A serious problem facing the entire program is the overall use of potential raw materials and their availability or, in some cases, development for specific

biotechnological products and processes. It is to our advantage that some biotechnology products do not require large quantities of basic raw materials and that some biotechnologies can be developed without demands on raw materials (managed livestock breeding, almost all plant production, etc.). The introduction of production of several biotechnological products and processes will lead to a substantial reduction in requirements for basic raw materials, materials, and energy (the use of atmospheric nitrogen, the integrated protection of plants).

An important precondition for implementing the program's objectives is the timely availability of innovative resources for both current and future tasks. It is assumed that efforts will be made to define these areas widely (raw materials base, technological and technical solutions, efficient production, effective utilization techniques) and to ensure that the delivered resources are of the requisite quality. The idea underlying the Long-term Comprehensive Program is to link this requirement to the exploitation of domestic and foreign sources of innovation, based on a project-by-project evaluation and economic feasibility. To obtain the needed scientific, technological and technical background the following sources of innovation will be drawn upon in an appropriate mix:

--the results of Czechoslovak basic and applied R&D;

--the results of international scientific cooperation, division of labor, collaboration and specialization;

--technology transfer (working and prototype models, licenses, "know-how," information procurement, production batches, leasing);

--improved acquisition procedures for and utilization of scientific and technical information;

--information obtained from programs for facilitating creative employee initiatives.

In order to obtain a comprehensive resolution much attention has been paid at the stage of program preparation to the requisite investment projects. The Long-Term Program for the Development and Application of Biotechnologies in the CSSR at present includes 130 projects with a total required investment of about Kcs 11 billion. In view of the special character of biotechnologies, these projects are both small and large and more or less investment-intensive at varying times during their operation. The entire pre-production stage has been completed for some and these have been included in the draft investment plan for the Eighth 5-Year Plan. Some cannot be proposed for inclusion as yet because their feasibility is contingent on research results that are not yet available. For this reason this part of the program is considered open and will gradually be specified in greater detail.

The approved set of investment projects represents a selection of the most effective projects, which are basically the outcome of R&D work. Every investment project will be evaluated individually before being included in the plan according to existing technical and economic criteria, social significance, relationship to foreign trade, and development of the international division of labor.

There is no longer any discussion concerning the need for the Czechoslovak economy to develop and set up biotechnological processes for the comprehensive development of production efficiency and the improvement of the environment. Biotechnology is one of the most important areas of the scientific and technical revolution, whose entire socio-economic impact will not be felt until after 1990. It is assumed that the economic efficiency of biotechnologies as a whole will increase as R&D results are gradually implemented.

The rapid growth rate of new findings on the properties of organisms and living substances will further increase, as will the developmental pace of those technological and engineering disciplines that focus on applying this research to projected new products.

Consequently, as findings in the most advanced countries confirm, expenditures on R&D exceed expenditures in production facilities in the first stage of development of biotechnologies.

In upcoming years this will be the case in the CSSR, although in certain primary developmental areas investments are already being paid back. This is especially true of selected biotechnologies that have been applied to livestock production (biochemicalization and chemicalization of livestock production), including high payback levels in foreign currencies.

In addition to economic advantages for users, significant contributions are projected for foreign trade. These will decrease imports and result in exports of significant amounts of biotechnical products. The fact that these goods will be produced with domestic raw materials and are not very energy-intensive makes it possible and even desirable to produce these preparations not on a limited scale only for the Czechoslovak market, but at optimal production levels so that the technical and economic aspects of production will be as favorable as possible. For instance, the export of veterinary preparations in 1984 amounted to Kcs 350 million; it is projected that by the end of the Eighth 5-Year Plan this figure could be increased by a factor of 2, to Kcs 700 million, and that further increases are possible later. In addition, it will be possible to consider expanding exports of preparations related to health care and, after building the necessary production facilities, planning for the export of enzymes and other synthetic biological products. In terms of commodities the export of particularly new and original products to CEMA countries and to markets in nonsocialist countries will continue and expand. Cyadox is one such product.

Sectoral and divisional variety and the need to resolve a number of problems immediately requires a high degree of managerial flexibility.

Basic Approaches

In formulating the current and long-term objectives and tasks of the Long-Term Comprehensive Program, we proceed from the fact that innovative new biotechnologies can make an immediate contribution to improving health care, better protecting the environment, better utilizing raw materials, improving labor productivity, efficiency, yields, use efficiency, and quality. They can help to improve production intensity and effectiveness in a number of areas, including: diagnostic and therapeutic measures in human medicine, the production of antibiotics, selected amino acids, and other organic acids, the production of serums and vaccines, the improvement of traditional foodstuffs, the intensification of plant and livestock production, the further development of the fodder industry, increased efficiency of waste water purification facilities, etc. Innovative new biotechnologies result in gradual, yet far-reaching changes in specific sectors which will result in new products with new usage features.

Innovative new biotechnologies have applications in a large number of various products and sectors and therefore must be implemented, because of the structure of the Czechoslovak economy, in various organizations and sectors. This structure must be gradually and purposefully adapted to the requirements of the unified management of the entire development and application of biotechnologies in the intensive development of the Czechoslovak economy. The common problem of the development and application of biotechnologies is to ensure that the necessary links exist between basic and applied research, in international cooperation, in personnel training, and in securing raw materials, other materials, reagents, machinery, equipment, instruments, etc.

Basic research is and will continue to be a critical element in implementing the program for further development of biotechnologies. To achieve the goals planned for this period the resources and capabilities of basic research are being focused on priority basic research projects. These include techniques of gene manipulation, microbiological processes, immobilized biological systems, plant explants, their utilization and cultivation and increased plant production.

The tasks in these priority projects have from the very beginning been geared towards specific practical application of R&D findings and development of methodologies for new biotechnologies. The completion of other tasks essential for the development of biotechnologies is being handled at worksites of the Czechoslovak Academy of Sciences [CSAV] and the Slovak Academy of Sciences [SAV]. These include tasks in enzyme engineering and in microbe systems, process engineering and automation of microbiological systems, breeding of microorganism groups, preparation of technologies for monoclonal antibodies, biotechnologies in the reproduction of livestock, providing Czechoslovak requirements for immunomodulators.

In view of the interdivisional and frequently even intersectoral nature of the resolution of biotechnological problems, it is assumed that when specific tasks are resolved and when research results are implemented new relationships must evolve between basic and applied research and between research and application. New technologies, methodologies and principles, mastered so far only in basic research institutes, will be put into practice in new organizational forms, i.e., in scientific-production associations or at joint implementation worksites.

In conjunction with basic research, technical developments, including pilot plants, verification procedures and product implementation, will be handled through State Scientific and Technical [SVTP] and State Priority Programs [SCP]. The basic tasks are contained in SVTP-11, Selected Biotechnologies Inluding Machinery and Equipment, SVTP-06, Selected Problems in the Agro-Food Complex and SVTP-12, Health Care for the General Public. The implementation focus of these projects is evident from SCP-09, a subprogram entitled Veterinary Medicine and Specifically Effective Substances. In the context of this subprogram, the Research Institute for Biofactors and Veterinary Medicine will build, for instance, an experimental pilot plant with a fully automated verification line.

The construction of functional and methodological centers for cultivating microorganisms is of critical importance for the further developing biotechnologies. This activity has been previously underestimated in this country although it is a critical component in implementating the entire program of development and application of biotechnologies. For this reason the CSAV has developed a unified concept for cultivating microorganisms on the basis of which a cultivation center has been built by the Microbiological Institute of the CSAV. This facility focuses mainly on the high-level cultivation of microorganisms. There is also a biological center in Modra which, in conjunction with the Food Industry Research Institute in Bratislava, will deal with the cultivation of microorganisms mainly for the needs of the food industry. Finally there is a biological center at the Biotika Plant in Slovenska Lupca, which will cultivate microorganisms primarily for livestock production.

The broad spectrum of biotechnologies which have been projected for long-term development and application in Czechoslovakia requires a more precise approach to their development, data-collection, and planning and control of research and implementation. For purposes of control and rapid decision-making, an automated information system has been developed which will be capable of providing, whenever necessary, all the information needed to make a decision. Also under development is a so-called Open Registry of Biotechnologies and Bioprocesses, intended to serve as a basis for development of an automated information subsystem for biotechnologies.

The sectoral and divisional variety of individual tasks and the need to resolve a number of fundamental problems require great flexibility in planning, management organization and coordination, above all in the conceptual, methodological, scheduling, and physical accommodation of relationships, particularly:

--in all phases of the capital replacement process (from basic research through utilization);

--in securing international cooperation, collaboration, and integration;

--in implementing capital construction projects.

For these reasons it is also assumed that in managing the program use will be made of maximally flexible organizational and management forms that will enable effective monitoring and evaluation of the ongoing program.

Objectives for Individual Sectors

Development and Application of Biotechnologies in Livestock Production

The overall development strategy for livestock production and its composition in the CSSR is dictated by the requirement to manage effectively existing fodder sources and the requirement to intensify its major divisions, primarily meat production. The more consistent implementation of biochemicalization and chemicalization of the feeding of livestock will result in further improving the efficiency of fodder, consumption in addition to reducing losses and protecting high-yield animal populations from the stresses of a mass production environment.

To achieve these goals an across-the-board application is planned of biofactor supplements, whose production will increase in accordance with developments in fodder mix production, of about eight percent in the Eighth 5-Year Plan. This will require us to obtain specifically effective substances for the production of biofactor supplements without incurring additional foreign currency obligations.

Taking into account the needs of livestock production, the Czechoslovak raw materials base, the state of R&D work on production technologies, and the potential of the Czechoslovak economy, it is expected that production will start on individual substances related to biochemicalization and chemicalization of livestock production. This is primarily a matter of producing the following biofactors:

a) Lysine, an essential amino acid, which is a necessary and irreplaceable component of animal nutrition. It affects the utilization of fodder, especially of proteins, and thereby the potential for increasing pork production with smaller doses of fodder. Research will be directed towards increasing production, reducing production costs, reducing sucrose consumption, using its technical forms and reducing the energy-intensive nature of production by at least 20 percent from the current figure;

b) threonine, which is vitally necessary for the nutrition of hogs and poultry given increasing shortages of animal proteins in fodder mixtures. It is also

used in human medicine as a component of infusion solutions. Production will be based on a Soviet production strain and laboratory techniques for threonine production that use available Czechoslovak raw materials;

c) olachindox, a non-antibiotic growth stimulator of a chinoxaline type, which increases the growth of live weight while improving fodder conversion when used in raising pigs and fattening hogs;

d) cyadox, a non-antibiotic growth stimulator developed in Czechoslovakia, also of the chinoxaline type. It has significant antibacterial effects and, when combined with antibiotics and sulfonamides, it may be used for treating and controlling mass infections in large feedlot operations;

e) monensine, a polyether-type antibiotic which, in addition to an anti-coccidial effect in poultry, augments daily increases in live weight during the feeding of cattle and improves fodder utilization, assuming balanced doses of fodder. The development of fermentation techniques of production will occur within the context of an appropriate state priority program. A pilot plant is now under construction at the Research Institute for Biofactors and Veterinary Medicines, with production slated to start in 1988;

f) an important objective in this area is to guarantee sufficient supplies of the basic vitamins A, $B_2$, C, $D_2$, $D_3$, and E. The production of vitamin C is planned and will be considered a basic resource for health maintenance. The other vitamins should not only maintain healthy herds but also ensure proper weight gains and use efficiencies for livestock. The main purpose of vitamin production is to make production more efficient and to provide a stable source of raw materials;

g) tylozine, an important veterinary antibiotic for the treatment of mass sicknesses of livestock. Other preparations will be produced for the prevention and treatment of serious illnesses of all types of livestock (such as biosynthetic antiparasitic drugs, anthelmintic drugs, and hormonal preparations);

h) anabolics, which are growth stimulators. Research will be focused on the experimental verification of the effectiveness of selected anabolics and their combinations in the feeding of cattle, the development of new forms of these substances, the development of appropriate analytic techniques for detecting anabolics, the study of the pharmacokinetics of tested substances in conjunction with the method of application, etc.

Work and research regarding controlled livestock reproduction is an independent group of tasks within the area of the development and application of biotechnologies to livestock production. This is mainly a question of ensuring that individual phases of the reproduction cycle as well as the entire production process are organized according to the proper schedules and groupings at the same time that the most effective possible use is made of the natural production and reproduction potential of the herds and the amount of human work and care involved is simplified as much as possible.

The program of managed production is aimed at an across-the-board application of a system and techniques of managed reproduction and the progressive, repeated utilization of state-of-the-art genofunds for economic animals. Related tasks are divided into two important areas of the managed reproduction of economic animals under mass production conditions:

--biotechnical methods aimed at effectively obtaining and producing new individuals (insemination, embryo transfer, oocyte cultivation, etc.);

--influence and control of the reproduction cycle (management and control of the estrous cycle, detection of rut and heat, birth induction and synchronization).

In terms of practical applications it is projected that management of and intervention in the estrous cycle, the detection of rut and heat, and the induction and synchronization of birth will be implemented across the board and that insemination will be expanded to include all types of livestock. In contrast, the cultivation of ovarial oocytes, in vitro fertilization, the micromanipulation and detection of the sex of livestock and the collection, transfer and long-term storage of embryos will be implemented selectively only for state-of-the-art genotypes at our most advanced agricultural factories.

To assist in controlled livestock reproduction, production will be initiated of new, state-of-the-art preparations with hormonal effects that are based on prostaglandins and their analogs, polypeptides, and ergotamines.

Development of the Microbiological Industry

Providing for the development of a microbiology industry is one of the basic conditions for applying biotechnologies in agriculture, the food industry, health care and the pharmaceuticals industry, industry and the environment. It is to a large extent the key link between basic and applied research. The top priority task is the building of functional and methodological centers for cultivating microorganisms, constructing experimental fermentation units for developing new biotechnological techniques, building laboratories and special production units for genetic manipulation and hybridoms. A number of investment projects, including the fodder yeast project in Vetrni, selected enzymes, citric acid, and submersion production technologies, will all depend on research results.

It is projected that within the context of the task Microbiological Industry, the production of various products will be established that reflects historical experience, the level of technical and technological sophistication that we have reached, the extent to which production is concentrated, and national economic significance. These products will include fodder proteins, products from fermented biomass, organic acids, ergotamines, antibiotics for human and veterinary medicines, edible mushrooms, and phytomass hydrolysates. For all the products, the production of all the products and the key to increasing production levels and reducing costs will be the cultivation of strains of appropriate microorganisms and, in the case of mushrooms, the capability for cultivating appropriate spores.

The utilization of extensive experience in the production of fodder yeasts from differing raw materials and in the production of the necessary production equipment is the key to obtaining adequate raw materials and appropriate production costs, thereby making it possible to complete research in this area.

Biological waste water purification facilities generate large amounts of activated sludge formed by the biomass of various microorganisms. This biomass includes proteins, enzymes, polysaccharides, lipids, sterols, and other substances that can be utilized. The best approach would be to use this biomass comprehensively. To do so we must be sure that there are no problems with this sludge.

The long-term concept for developing the microbiological industry includes the application of plant and milk proteins to the production of foodstuffs and especially of meat products. In the technical area fermentation cells will be separated effectively in isolation processes. After cultivating the fermentation substance with an improved protein compound, a more favorable evironment can be created for utilizing fermentational biomass.

The plan for developing production of the so-called food-industry organic acids (citric, lactic, tartaric, and malic) includes efforts to provide all the necessary research and technical, production and economic (pricing) facilities necessary to achieve greater flexibility and easier switching between the production of each.

Expanding the production of citric acid depends on advancing Czechoslovak research into the pilot plant testing stage. This is of critical importance in cultivating more productive mold strains for submersion fermentation. Because there are still no facilities for submersion fermentation, surface fermentation will be used to expand production. Instead of importing spores, a production facility for spores will be built for the inoculation of citric acid fermentation.

Obtaining appropriate strains of microorganisms will serve as a basis for the production of L-lactic, L-malic and tartaric acids. The only economically feasible way to expand production of ergotamines will be to set up industrial-scale fermentation processes for preparing ergotamines. In addition to expanding production, microorganism fermentation techniques and final medicinal products will be developed.

Doxycycline will gradually replace domestically-produced tetracycline and oxytetracycline, as well as foreign preparations based on doxycycline which are currently imported. The effectiveness of this substance is greater by a factor of about 10 than the antibiotics that it is replacing. Moreover, it has fewer side-effects. The first related task is improving production for preparing active substances so as to reduce production costs to a level closer to that elsewhere in the world.

Cephalosporine antibiotics are effective, broad-spectrum substances, designed for treating highly infectious diseases when treatment with penicillin type antibiotics is ineffective because the organisms causing the infection are penicillin-resistant. Because the import price of the basic substance is very high, domestically-produced cephalosporine antibiotics will cost about 50 percent less as medicine.

Another task is to improve production of antracycline antibiotics, which are effective against tumors and which are used with other preparations and other forms of treatment. The key intermediary product in the production of adriamycine is daunomycine. Plans, therefore, call for cultivating appropriate basic materials and studying the biosynthesis conditions in order to make the process more efficient as well as to prepare and test other derivatives with fewer side effects.

The main task in the production of edible mushroom pilei will be to increase their yield per unit of substrate and to decrease the labor involved per unit of production. This will involve development of improved production processes and further concentration of production facilities. It will also be necessary to concentrate further the production of mycelia using new strains and new growing techniques. The goal is to reduce the production costs of edible mushroom pilei by at least 40 percent.

The hydrolysis of lignocellulose materials can provide the basic carbonaceous raw materials for almost all products of the microbiological industry, thereby replacing the raw materials traditionally used. We are directing attention at more economical forms of hydrolysis by combining chemical and enzyme hydrolysis.

The Use of Biologically Active Substances and Tissue Cultures.

The field of tissue cultures includes all techniques that facilitate the cultivation of cells, tissues and organs of multicell organisms under in vitro conditions for the performance of both research activities and the production of biologically active substances. Tissue cultures represent an indispensable technology for the production of innovative antiviral vaccines, diagnostics, medicines, and products prepared by genetic manipulation in eucharionts cells, and the preparation of cloning organisms.

Biologically active substances include all substances produced by living organisms in vivo and in vitro and synthetic substances that have a biological impact (from antibiotics to amines, antimetabolics, etc,). It is projected that research will focus mainly on biologically active substances that can exert an effective impact on the defense, i.e. the immune, system of an organism.

The comprehensive conceptual strategy for approaching the issue of tissue cultures within the program for the development and application of biotechnologies has the following objectives;

a) gradual provision of requirements of the user sphere (research, production and control);

b) ongoing development of tissue culture techniques at a state-of-the-art level, with innovations in the product mix and production techniques designed to increase production capacity, the quality of final products (vaccines, diagnostics, animal cells, etc.), reducing the risk of infection during production, and the introduction of new technologies such as the production of monoclonal antibodies, the use of eucharistic cells for gene manipulation, etc.

The successful attainment of these strategic objectives requires that progress be made on the following specific problems:

--providing a qualitatively and quantitatively appropriate raw materials base for tissue culture production (cultivational media, buffering solutions, etc.);

--setting up production of serums from mature cattle along with fetal beef serum of the requisite quality and quantity;

--introducing economically and quantitatively effective production techniques for tissue cultures of biologically defined quality (microcarriers, rollers, and others);

--the effective utilization of tissue cultures in research, diagnostics, the production of diagnostic materials, vaccines, monoclonal antibodies, interferon, immunomodulators, and other biological preparations.

The CSSR is well equipped to keep pace with state-of-the-art developments thanks to a well-developed R&D base in the field of plant and tissue cultures, the chemistry of natural substances and the development of synthetic carriers for immobilized systems. In view of the current status of research, a number of problems will soon be resolved at the level of basic research. These include particularly the regulation of growth and differentiation, cloning, cell immobilization, and the development of effective techniques for the chemical analysis of selected secondary substances. At a later stage institutes of applied research will be involved in this work, primarily in transferring laboratory results onto a larger scale. Plans in this area of applied research call for the application in the very near future of explant culture techniques for potatoes, strawberries, and decorative flowers that will result in healthier, more advanced forms of given cultivars and possible crosses. It will be possible to use these results in the cultivating fodder crops to improve the health mainly of alfalfa and some grasses that are used as fodder, etc.

The main objective of work in the field of monoclonal antibodies is to transfer preparation techniques from basic research to the implementation stage as a new and promising technology. It is projected that with the problem-solving capabilities of our basic research facilities the production of diagnostic systems based on monoclonal antibodies will bring significant economic advantages to both producers and consumers by the end of the Eighth 5-Year Plan through the mastery of new diagnostic techniques.

Setting up a sector devoted to monoclonal antibodies will require:

--collection of standardized hybridoms to prepare monoclonal antibodies and diagnostic systems based on the use of a portion of the problem solving-capacity of the state basic research program and in cooperation with production enterprises.

--construction of pilot plant and production facilities within production enterprises of the appropriate sphere (the Institute for Vaccines and Serums, Sempra, Imuna, Bioveta). In these enterprises construction units will be set up.

--the creation of a methodological center administered by the Czechoslovak Academy of Sciences [CSAV] for training the necessary personnel within the production enterprises to determine the potential for selecting hybridoms that are ready, with the objective of perfecting this technology as a component of the production of new diagnostic preparations.

A basic precondition for successfully developing hybridom construction and production of monoclonal antibodies is the full resolution of the production techniques for animal tissue cultures and the availability of the necessary raw materials and production facilities. In addition, work in this area is meant to make progress in establishing divisions and laboratories specializing in gene manipulation in the implementing enterprises (Spofa, Milk Industry, the Institute for Vaccines and Serums and others) and the training of the necessary numbers of qualified people.

Application of Biotechnology to Agriculture

The application of biotechnologies to plant production involves a very extensive and highly differentiated complex of problems, whose resolution will lead to increased, stabilized agricultural production; protection of the environment; effective utilization of biological energy systems; and development of waste-free technologies.

Explant Cultures of Plants

The objective of work with plant explants is to develop the findings and methodology of new, in vitro biotechnologies, the culture of isolated cells, cell groups and higher plant organs for the purposes of:

a) the propagating and preserving the viability of plants, protecting the plant genofund, expanding genetic variability including the induction of polyploids and haploids;

b) selecting economically significant signs, especially resistance to phytopathogens, biotic and abiotic stresses;

c) using gene manipulation as a technique for enhancing new types and cultivars of economically significant plants.

Explant culture for potatoes makes possible the treatment and rapid propagation of cultivation materials. This technique can be used to protect potatores from viral, bacterial, and degenerative diseases. Tissue culture equipment makes it possible to propagate material under sterile conditions. We are projecting that the cultivation cycle in the production of $S_1$ sets will be shortened by at least a year.

The application of explant cultures to fodder crops makes it possible to develop techniques for obtaining new types of plants with specific properties, preserving the viability of original cultivation material, propagating the most valuable genotypes and developing interclonal and intergenus hybrids. Embryo cultures will be used to develop a Lolium X Festuca hybrid with a yield potential of 10 tons per hectare, with improved quality and resistance to rust.

An expansion in the area of legumes is planned in the genetic variability of peas, beans, and soybeans. For these types increased genetic variability is aimed mainly at increasing the protein content of the seed, reducing the anti-nutritional content of the seed, accelerating the vegetative period, and increasing yields.

Explant cultures of sugar beets make possible the cultivation and intensive reproduction of healthy plants and basic material at a diploidal and tetraploidal level, and speeds up the formation of new cultivars with the requisite economic properties.

In vegetable production plans are to utilize tissue cultures mainly in the micropropagation of improved lines within the context of the maintenance cultivation of hybrid cultivars and in new improvements, as well as in the treatment of all vegetatively new genetic sources, particularly when cultivation involves the use of the haploidal and diploidal phases (anther cultures), the induction of polyploids, mutagenesis, and the testing and selection of resistant forms in vitro.

The use of plant explant cultures in fruit production consists mainly in treatment of vegatatively and generatively propagated plant types, micropropagation of cultivars and clones, mutation cultivation, the use of embryo cultures to overcome dormancy and resistance to cross-cultivation.

The introduction of these technologies will shorten the cultivation cycle for smaller fruits by two to three years and that of kernel and stone fruit by five years. It should increase fruit yields by at least 20 percent by correcting the current unsatisfactory health situation in the fruit industry, limit imports to only state-of-the-art innovations or components for cultivation at a particular time that will work in combination with domestically produced test serums.

Biological Pesticides

Introduction of integrated plant protection using biological insecticides is planned in the battle against harmful insects. This should result in

substantially lower doses of chemical insecticides in order to hold the insect population under the level where it causes harm. Mycoinsecticides, i.e., preparations based on entomopathogenic mushrooms, are becoming one of the important components of this biological struggle against pests.

Production of Humus Concentrate

The objective of the production and use of humus concentrate is to utilize the stimulative effects of dispersed or finely dispersed humus materials, primarily the acids contained in humus, to achieve additional per hectare revenues of Kcs 56 for grains, Kcs 518 for silage corn, Kcs 5,454 for sugar beets, and Kcs 1,248 for potatoes. The humus concentrate should contain 8-10 percent dry materials so that it can be stored in unlimited quantities.

Biotechnical Regulation of Compost Production

Currently in the CSSR about 1.9 million tons of compost is produced every year. By applying industrial techniques it is anticipated that production can reach about 3.7 million tons annually (after 1995), and quality will increase substantially. The raw materials base, however, will change somewhat. We will no longer use peat moss, but will replace it with increasing percentages of residential wastes and tree bark, corn stalks and other waste products from the harvesting and processing of timber (brush and sawdust). The objectives of these new technologies are, on the one hand, to increase the content of beneficial organic substances in the soil and, on the other hand, to convert secondary raw materials into organic fertilizers.

Production and Use of Biomass of Autotrophic Microorganisms

Algae production is one of the promising forms for utilizing the energy in solar radiation to produce cellular materials. The potential for utilizing algae as a fodder supplement, a component in foodstuffs and a valuable raw material for the pharmaceutical industry have been demonstrated many times in our own laboratories and in other countries. There are plans to use algae to raise fish in heated water. It is possible to create a closed ecological cycle in which the algae serves as a food component for the fish as well as a means to purify the waste water from fish raising. It will be possible to extend the cultivation period of algae from 120 to 180-200 days with low potential waste heat.

Symbiotic Fixation of Atmospheric Nitrogen

A fixation rate of 70-140 kilograms of atmospheric nitrogen per hectare annually can be achieved through use of effective innoculants, modification of symbiotic relationships among legumes (beans, clover, alfalfa) and Rhizobia, and modification of the location and ecological conditions for plants cultivation.

Developing the Production and Utilization of Enzymes

Enzymes are biological catalysts that resemble proteins and have a highly specific catalytic affect. In addition to their wide application in the

production of foodstuffs, their importance is increasing in other branches of the economy, including the consumer goods, chemical, pharmaceutical, textile, paper, and leatherworking industries, agriculture, medical diagnostics, and R&D. One of the important contributions of the industrial use of enzymes is the possibility of replacing chemical catalysts with biochemical catalysts that are less energy-intensive, as well as fast-acting, specific, and which simplify the production process.

To date the CSSR has been successful in mastering on an industrial scale only the production of bacterial alpha-amylases. This preparation is used in the textile industry to desize fabrics. Its domestic production has made it possible to end entirely imports of this product.

Work is being completed on research in production techniques for alkaline proteases in order to optimize these techniques and isolate the enzyme in a processed, stabilized form suitable for use in laundry products.

In the agriculture and food sector new, more easily utilized sources of livestock fodder will be provided partly through the enzymatic processing of wastes from primary plant production and other lignocelluse materials. New production techniques will be introduced in the food industry. Moreover, more equipment that uses enzymes will be produced. In industry innovations will be introduced in leather processing and, in the future, production techniques will be improved for selected organic compounds that will conserve significant amounts of energy and substantially reduce their negative impact on the environment.

It will be desirable to direct production facilities towards the production of large quantities of enzymes for economic, energy and raw materials reasons. Such enzymes include alkaline proteases, bacterial alpha-amylases for the food industry, gluco-amylases and cellulases.

Specialized producers in the developed countries currently offer roughtly 400 preparations of pure enzymes.

To eliminate essential, but ever increasing, demands for importing pure enzymes for diagnostic purposes, production processes will be developed and production of a selection of enzymes for diagnostic purposes will be gradually phased in. The objective of this program is to meet basic Czechoslovak requirements and to lay the groundwork for eventually exporting these preparations.

Application of Biotechnologies to the Processing Industry

The broadest definition of biotechnologies includes all fields in the food industry because food production is, actually, the modification of the properties of a biomass which must, along with the direct consumption of agricultural products, meet the nutritional needs of the population.

In conjunction with the projected development of the food industry and improvements in the quality of the available food supply, most of our attention will be focused on the following areas:

a) innovation in, and modernization of food industry fermentation sectors. This part of the program will include;

--application of enzyme techniques in the food industry;

--application of microbial cultures in the food industry;

--application of findings from process engineering in microbiological products;

--in part, production of biologically active substances and adding value to auxiliary raw materials;

b) the application of enzyme technologies in the food industry which belong to traditional procedures in food production, and which utilize the effects of enzyme systems of raw food materials or classical enzyme sources (malt, yeast). Developing production and application of microbial enzymes and enzymes from other non-traditional sources will contribute to a substantial expansion of the product mix, improved production efficiency, improved functioning for the end user (modified starches and proteins, enzyme laundry products) and the introduction of completely new products and production processes (sweeteners from amylaceous raw materials, the use of whey and milk sugars, increasing shelf-life);

c) application of microbial cultures in the food industry based on traditional food industry fermentation processes. Production and utilization of microbial cultures with controlled technological properties will become an essential part of innovative fermentation products and will, with the continuation and automation of operations, completely replace spontaneous fermentation, particularly where stabilized microbial systems will be introduced. Improved wine yeast cultures will be utilized in intensified wine production and in biological techniques for wine stabilization. Lactic bacterial cultures will be used in the production of special soft fermented cheeses, sour milk products and proteins, and whey drinks;

d) production of biologically active substances that will be based on the effective utilization and valuation of auxiliary and waste products from the food industry. There is a wide variety of such substances. They can be used as raw materials in the pharmaceutical industry and the cosmetics industry and as additives in the food industry.

Within the context of the Long-Term Comprehensive Program, the food industry will conduct research on: the enzyme production of malt and fructose syrups; the production of rennets from non-traditional sources; the delactization of milk; the use of bound yeasts in the production of beer and wine and of bacterial concentrates in milk fermentation; the potential for using other secondary raw materials to produce biologically active substances; and technical innovations in fermentation products.

Developing the Basic Research Necessary for Modern Biotechnologies

The theoretical basis for the development of modern biotechnologies in the CSSR in the Eighth 5-Year Plan is three priority projects in basic research that represent fundamental advances in conventional biotechnologies:

--techniques of gene manipulation;

--microbiological processes;

--immobilized biological systems;

--plant explants.

Tasks that are being developed in these projects have from the start been supported contractually with public sector orders and have focused on establishing and implementing higher level innovations in biotechnology.

Gene Manipulation Technologies

The objective of this project is above all to develop and test techniques for influencing specific genetic information in cells. This is applicable to genetic engineering (the application of techniques that intervene in the genetic apparatus of cells at the level of the genes or gene groupings) where the following problems are being worked on:

--calf rennet: chymosine, a bacterial preparation for the needs of the milk industry. One goal is to increase the production of chymosine in the E. coli bacterial strain, which was first established in 1984 at an economically viable level. In addition, efforts are being made to exploit other appropriate hosts for producing chymosine, and to develop simple and efficient procedures for extracting and purifying chymosine;

--immunomodulators; the objective is to prepare subtypes of human interferon-alpha and interferon-gamma for use in medicine with techniques of genetic manipulation; to isolate, clone and extract the pertinent genes; to develop techniques for isolating interferon. This includes preparation of human interleukin-2 using genetic manipulation techniques;

--developing a univalent vaccine for flu innoculation, achieving the ability to extract the flu virus gene that had been cloned in the Seventh 5-Year Plan in single-celled organisms and in mammal cells; testing the antigen impact of these products on laboratory animals;

--industrial microorganisms. This involves introducing techniques of genetic manipulation in cultivating and constructing industrially important and promising microorganisms. It includes use of genetic manipulation techniques to obtain strains of industrial microorganisms and yeasts capable of utilizing starches;

--enzymes for modification and transformantion of nucleic acids; also the development of facilities for preparing enzymes for genetic manipulation at selected worksites.

Cell Engineering:

This involves influencing metabolic events in cells, above all the technique of cell fusion, in which the resultant hybrid cell retains to a certain extent the characteristics of both original cells. In this field it is necessary:

--to construct hybridoms producing antibodies against the herpes and hepatitis viruses, the flu virus, and plant viruses, together with practical application in diagnostic systems;

--to form the basis for innovative production technologies for monoclonal antibodies with research on factors that control the proliferation of lymphoid and hybrid cells;

--to use genetic manipulation to improve the properties of economically important plants;

--to apply genetic manipulation techniques to animals.

Together these tasks form a unified base for methodological adoption of "know-how" in the pertinent spheres of applied research and practice.

Microbiological Processes

The objective of this project is to create the theoretical, methodological and technological preconditions for developing new biotechnological techniques based on the use of microorganism cultures, algae, macromycetes and related organisms. Promising applications of this project include above all the comprehensive use of soil microorganisms to improve the growth and nutrition of cultivated plants and to protect the environment. The use of physiological, biochemical and genetic techniques will aid in developing procedures for the biotechnological exploitation of soil microorganisms that are important for improving soil fertility, plant production, and environmental protection, with particular reference to increasing the biological saturation of the soil and plants with atmospheric nitrogen.

Appropriate microbe preparations will be manufactured that can be applied to plants' seeds or roots. These new preparations will contain selected live microorganisms capable of colonizing the root network or the surface of plant roots. They will stimulate plant growth by improving nutrition, producing phytohormones and protecting plant roots from attacks by phytopathogens.

Another field will be the study of the growth and products of cultures of microorganisms, algae, and macromycetes on non-traditional substrates using new biotechnological procedures. Based on the results of planned basic research on

cultures of microorganisms, algae, macromycetes and related organisms, we will develop new biotechnology procedures for using non-traditional substrates, including selected waste and excess materials or energy (such as the C-1 component of the lower aliphatic alcohols, lignocellulose raw materials or their components, carbon dioxide, waste or excess thermal and electrical energy), with particular attention to the production of biomass, its protein and other components, biologically active substances, and other products.

Immobilized Biological Systems

The objective of this project is to conduct comprehensive research on the mechanisms of bioconversion at the molecular level and to optimize the properties of biological catalysts and other biologically active immobilization substances on solid carriers. The goal is to increase their stability and usefulness in new and primarily continuous biosynthetic production processes. In addition, the project is aimed at the possible utilization of highly selective enzymes as catalysts in chemical reactions (particularly small batch organic synthesis), the use of enzymes and other immobilizing, biologically active substances in analytical work for the difficult monitoring of very low-substance concentrations in production and agricultural environments, and in diagnostics and enzyme modification. The goal is the modulation of their biocatalytic impact and the use of information gained from immobilized, biologically active substances in vitro to understand better the laws governing the actions of these substances in vivo, where they are bound to a biological structure. An important public goal of the project is to achieve state-of-the-art knowledge in this area of biotechnology and to develop the foundations for processes that are less technologically and energy intensive.

The primary contribution of the projected outputs of these projects will be innovation and enhanced efficiency of certain classical biotechnologies and introduction of new biotechnologies that are less energy intensive and economically more advantageous for us and which have less negative impact on the environment. In the field of the study and regulation of vital processes, these programs will result in new diagnostic techniques and pharmaceuticals.

Plant Explants, Their Use in the Enhancement and Increased Productivity of Plants

The goal of this project is to gain a theoretical base for the broad application of biotechnologies in improving plants in terms of the formation of new, highly productive cultivars of cultivated plants. The basis of this priority program is the creation of a data and methodological base for cultivation biotechnologies, and especially for the culture of cells isolated in vitro, cell groups and organs of higher plants.

In its final phase the implementation of new processes in plant cultivation includes plant regeneration from original explants, or from cell and organ cultures, using controlled morphogenesis under in vitro conditions. The priority project also concerns basic research on the physiological and genetic mechanisms

controlling the growth and development of plants with an emphasis on the metabolism and physiological functions of phytohormones and their systemic analogs (growth regulators). A key problem is to obtain general information on the mechanisms of morphogenic processes that occur at the level of isolated cells and cell populations and their specification for the most important agricultural crops. Genetics research on somatic cells will be focused on controlling the genotypes of specific morphogenic capabilities and the cell totipotence of higher plants. Research in cultivation biotechnologies, broadly defined, represents the theoretical basis of a new, nontraditional system of plant cultivation from which may be expected the development of effective techniques for the propagation of plants and new techniques for the protection of plants from viral, bacterial, and degenerative pathogens.

The Training of Personnel

The broad spectrum of biotechnologies contained in the descriptive parts of this program have a direct impact on the means and level of training that must be provided for personnel. For this reason the following basic system will be followed:

a) In the area of establishing production and process facilities where the use of biotechnologies means innovative production technologies, improved quality, productivity and the like, the problem will be to develop (or supplement) intellectual and sensomotor capabilities and knowledge of specific functional levels according to the professional field, and modified by the requirements of specific biotechnologies. This will apply mainly to most agricultural and food industry sectors and, to a lesser degree, to others;

b) Stricter requirements for quality and form will be formulated for the field of R&D, the introduction of production and process operations for new products, or higher level innovations where development and use will necessitate somewhat different or a completely new theoretical and applications data base for those operations that have to date recruited graduates from specific fields. This will apply mainly to certain light biotechnical production and process operations, but also, for instance, to bioelectronics and bionics. In specific instances, where necessary, totally new sectors may be set up. The formal structure for providing the qualified personnel needed for developing and applying biotechnologies and which depends on the above mentioned basic classifications, will be subordinated, as an entire system, to the following objectives:

--in the first phase of program implementation (i.e., for the Eighth 5-Year Plan), to ensure in a differentiated manner the necessary supplementary training for current personnel according to their professions and functions for biotechnological products already in production;

--during the Eighth 5-Year Plan (with practical application in the Ninth 5-Year Plan) to upgrade textbooks that deal with biotechnology in traditional agricultural, food industry and other sectors in such a way that future graduates of these programs will be able to develop in their chosen professions and positions the innovative potential of biotechnology and gain the necessary theoretical and practical knowledge and ability for the application of biotechnologies;

--to develop the necessary training programs for those biotechnology sectors which require significantly modified or completely new theoretical or practical data bases;

--the establishment (which again applies to college-educated experts) of disciplines related to the development and application of biotechnologies for which it will be possible to obtain college-level education from appropriate programs of study at foreign colleges (especially in the USSR).

The following forms will be the most widely used to provide the training for college students:

a) interdisciplinary studies (or a combination of interdisciplinary and individual study based on current disciplines and for selected, gifted students. The critical centers for interdisciplinary study will be college departments of natural sciences, pharmaceuticals, agriculture, veterinary medicine, forestry, and chemical engineering. Senior researchers at the CSAV, the practical researchers, and scientists from the transformation sphere (such as the agricultural services VHJ, the Spofa VHJ or the Chepos VHJ) will share in the pedagogical process in all its stages (thesis work, etc.).

b) to establish and develop gradually new or marginal disciplines only when a clear public need can be demonstrated and when it can be demonstrated that there will be graduates available to staff such a new discipline (in these cases proposals must be submitted that conform to the regulations of the CSR and SSR ministries of education).

The following principles will apply at specific levels of the educational system of the CSSR:

Elementary education. Programs for school-age youth, including Pioneer and and Socialist Youth League members, will be developed in order to stimulate broader awareness of the significance, functions, processes, procedures, techniques and uses of biotechnologies, and to acquaint younger people with basic concepts and experiences. Increasing the interest of school-age youth in biotechnologies will be implemented within the 1984 Program to Develop Child and Youth Participation in R&D Progress.

Blue-collar personnel. Basically all biotechnologies to be implemented within the CSSR (both new and modified-traditional) will require exceptional technical discipline, precision, and the mastery of specialized intellectual and sensory-motor skills in order to put them into production. This means that in biotechnological production operations it will be very important to train blue-collar workers. In some cases this will mean training workers whose jobs will require an appropriate high school and, in some cases, college education.

Training centers will develop on a discipline by discipline basis the necessary modifications to the fundamentals of professional training, and will keep these updated. The implementation will take place at training facilities and their VHJ.

Middle-level technical personnel. The development of biotechnology will not substantially increase the demands for the total number of high school graduates. There will, however, be a restructuring of qualifications, with immediate requirements being met from the ranks of graduates of those disciplines or groups of disciplines that have the most in common with biotechnologies.

Personnel with college education. The training of college-educated experts for biotechnologies is based on the fact that it is impossible to train an all-round expert in biotechnology because these technologies come from practically the entire spectrum of biological sciences, as well as selected chemical and technical areas.

Colleges are so far not making sufficient use of the possibilities given them by law No 39/1980, SBORNIK, concerning the establishment of interdisciplinary program at colleges based on public requirements for gifted students in individual study programs.

Because laboratories require sophisticated equipment at both the pre- and post-graduate levels, and in the interest of better utilizing resources, the training of personnel for biotechnology will be specialized in such a way that in addition to the basic knowledge from their chosen field they will be trained in special programs at the natural sciences department of Charles University and elsewhere. Specially equipped worksites will also be used for post-graduate programs and personnel training on a cooperative basis within the CEMA.

The fact that there is as yet no great consumer demand for biotechnologies represents a large problem for the training of biotechnologists at our colleges.

The critical sectors, i.e., the CSAV and the SAV, the ministers of agriculture and food, health care, forest and water management, and industry, must therefore provide for their future requirements for graudates from these areas through planning.

Other trained experts. Additional trained experts, primarily for the Eighth and Ninth 5-Year Plans, who will work as researchers and in the development and application of biotechnologies, will be trained in the following manner:

--by working with college-educated experts a) in post-graduate studies (innovative, specialized or to upgrade qualifications) at colleges; b) through specialized course at basic and applied research facilities; c) through specialized forms of professional training at sectoral training facilities;

--for high school-educated experts through post-graduate studies at secondary professional schools and through specialized forms of professional training (at sectoral training facilities);

--through stipend programs for upgrading qualifications at state-of-the-art operations at home and abroad.

The ministries of education of the CSR and the SSR, along with the sectors of agriculture and food, health care, forest and water management, will handle the development of the appropriate programs as well as their implementation.

Training of researchers. The training of researchers for biotechnologies is mandated by the current favorable modification of standards and is being handled by the CSAV, the SAV, and the ministries of education of the CSR and SSR. Institutes of the CSAV and SAV, at colleges and at applied research training sites are conducting basic and applied research in some areas of biotechnology.

In the interest of developing the creative potential in certain sectors of biotechnology that have not been fully explored or are high ranking, the following forms of study will be utilized:

--research fellowships at foreign facilities wihtin the CEMA;

--targeted research stipends to master new foreign achievements in science;

--research colloquia (with international participation) to work on solutions to the most serious problems in the development of biotechnology.

The CSAV, SAV, and the ministries of education of the CSR and SSR will work out the details of training researchers to meet program requirements.

Raw Materials Base for Biotechnological Processes

One of the main requirements for the development of biotechnologies in the CSSR is to provide a raw materials base. Saccharide substances, sugar, molasses and starch provide sources of carbon, the main raw material world-wide. In addition to sources of carbon the development of biotechnologies requires other biogenic elements, the most important of which are phosphorus and nitrogen.

Providing phosphorus and nitrogen is no problem for the CSSR. The situation is different, however, with respect to supplies of carbonaceous raw materials. For at least 20 years now lignocellulose materials, and especially industrial timber wastes, recycled paper and agricultural wastes, have been considered the raw materials of the future. We must assume that in the next five years the industrial utilization of lignocellulose materials as a major raw material for biotechnologies will be very difficult and complicated. This is because of the scattered locations of these resources, technical problems in hydrolysis, and above all, economics.

Hydrolysis is the object of world-wide research efforts and of basic research programs in the CSSR. Once an economical technique for the hydrolysis of phytomass has been developed (above all waste timber and agricultural wastes), turning these substances into saccharides that can be assimilated, the means for utilizing these wastes will be reevaluated and a portion of them will be diverted to improve the raw materials base for biotechnologies.

One feasible raw material for Czechoslovak biotechnology is beet sugar. From a resource management perspective it is necessary, however, to evaluate realistically the effectiveness of the use of beet sugar as a raw material in biotechnology. Opinions concerning the economic feasibility or lack of feasibility of the use of sugar in biotechnologies are being reevaluated in view of the low prices for sugar exports and the changed relationship between the price of carbon in sugar and the price of carbon in oil. Biotechnologies do not have as rigorous final product demands on sugar as the food industry does. Unrefined sugar and unthickened sugar juice are fully adequate for biotechnologies. This substantially reduces production costs, which, along with efficiency-enhancing measures in agriculture, will have a positive influence on the economics of sacharose use in biotechnologies.

In line with world trends we will spend time researching starch-related raw materials and especially corn and wheat starch.

Methanol can also be considered as a carbonaceous raw material for large-scale protein production. Methanol makes sense, however, only at certain price levels, assuming that long term contracts are signed with socialist countries, mainly the USSR, to ensure deliveries. Research will be conducted on production techniques for fermented proteins from methanol between 1986-1990 in the CSSR.

A significant increase is expected in quantitative and qualitative demands for corn-steep, a source of nitrogen and biostimulator in the production of enzymes, antibiotics, and amino acids. It will be necessary to construct production facilities for corn-steep in the form of corn starch plants so that it will not limit the development of certain biotechnological processes.

Soy oil is being used as a carbonaceous raw material to produce certain antibiotics. In addition it is used in a number of biotechnological products such as defoaming agents. Future demands for this raw material will continue to grow. Soy oil is one of the raw materials currently imported from nonsocialist countries. For this reason research is proceeding to replace it with more readily available products.

Conclusion

Long-Term Comprehensive Scientific and Technical Program for the Development and Application of Biotechnologies in the CSSR is a comprehensive document that establishes in detail tasks related to the further development of research and production. Most attention will be devoted to developing the technical base for biotechnologies capable of meeting the basic requirements of our R&D and industrial base in the form of the development and production of a loosely unified line of complex fermentation units, including the auxiliary apparatus and control systems.

An attempt will be made to develop and implement elements of a modular system, primarily for dosing, mixing, and aerating equipment, sterilization machinery, exchangers, and in the management and control systems of bioreactors.

Any other special requirements, especially for the phases of basic and laboratory research, will be obtained through imports.

The proposed production range of equipment, from the laboratory up through large-scale industrial installations and for corresponding processes, will be narrowed when feasible through cooperation and specialization within the context of the implementation of the Comprehensive Program for R&D Progress in CEMA Member Countries Through the Year 2000. This is priority objective No 5 of the Accelerated Development of the Biotechnology Program.

The development of biotechnologies will not be possible without the necessary growth in our research capabilities. The top priority for increasing personnel levels and non-investment grade assets will be in basic research. The VHJ is considering a relatively large increase in the number of employees and capital assets to ensure that the necessary machines and equipment will be available mainly for the needs of the food industry.

Despite the great complexity of the program and the attempt to resolve all problems involved in its realization, it is necessary to bear in mind that this is an open program that will be further refined and upgraded, especially in relation to the Comprehensive Program of R&D Progress in CEMA Member Countries Through the Year 2000, Priority Objective No 5, Accelerated Development of Biotechnology. This will make it possible for specific changes in the program to be smoothly incorporated into the state plan and into the specific tasks of VHJ and enterprises.

Glossary of Professional Terms

Adriamycine--anthracycline antibiotic used against tumors.
Aliphatic alcohols--methanol, ethanol, propanol and butanol.
Alkaline protease--an enzyme included in laundry products.
Alpha-amylase--an enzyme used mainly in the textile industry.
Anthelmintic--substance used against worm-caused diseases.
Antinutritional--antinutritional.
Assimilable--capable of being converted by microorganisms.
Biopesticides--pesticides of biological origin.
Bovine--beef-related.
Cephalosporines--broad spectrum semisynthetic antibiotics.
Cellulase--an enzyme complex that breaks down cellulose.
Cyadox--synthetic growth stimulator used in livestock production.
Daunomycin--anthracycline antitumor antibiotic.
Delactosization--removing the lactose from milk.
Diploidie--presence of two chromosome sets in the cell nucleus.
Dormancy--resting state of spores.
Doxycycline--a broad spectrum tetracycline antibiotic.
Embryoculture--nucleus culture.
Entomopathogenic--effective against insects.
Estrous Cycle--the rutting cycle in females.
Euchariont cell--a cell of a developmentally higher organism.

Explant cultures, see tissue culture.
Pharmacokinetics--the study of the speed of impact of pharmaceuticals.
Fetal--fetal.
Phytohormones--plant hormones.
Phytomass--useable plant material.
Phytopathogen--microorganism that harms plants.
Gene--basic unit of heredity.
Gene Fund--the stock of genetic material.
Glucoamylase--enzyme used in the breakdown of starch.
Haploidie--the presence of only one set of chromosimes in a cell nucleus.
Herpes virus--virus causing line blisters and other illnesses.
Hybrid--crossbreed.
Hybridom--joining two cells to produce a single cell of desired properties.
Chromosome--complex formation in cell nucleus made up of genes.
Chymosine--an enzyme utilized in cheese making.
Enzyme fixation--binding an enzyme to a firm carrier.
Immunomodulator--a substance that changes the immune reaction of organisms.
Interferon--a protein that improves an organisms immunity.
Interleukin--a protein with important applications related to the immune reactions of organisms.
Know-how--production strategy.
Coccidiosis--a parasitic disease of poultry.
Leasing--renting production equipment.
Leguminous plant--a plant capable of fixing atmospheric nitrogen.
Lymphoid--lymphoid.
Lysine--one of the basic amino acids.
Macromycetes--hooded mushrooms.
Monensine--anticoccidial antibiotic.
Monoclonal antibodies--antibodies obtained from originally a single gene population.
Morphogenic--changing shape.
Mutagenesis--the action of mutagenic factors with the aim of making genetic change.
Mycoinsecticides--substances to control hazardous pests, produced from mushrooms.
Olachindox--snythetic growth stimulator used in livestock production.
Oocyte--egg cell.
Ovarium--ovary.
Polyploidie--presence of more than two basic chromosome sets in a cell nucleus.
Polysaccharides--high molecular, sugar like substances (cellulose, starch).
Prostaglandins--biologically active substances used to synchronize rutting seasons.
Buffer--solution that maintains constant acidity in an environment.
Roller--rotating cultivator.
Submersion cultivation--microorganism cultivation on vibrating machines.
Sulfonamides--synthetically manufactured antibacterial substances.
Symbiotic nitrogen fixation--fixing of atmospheric nitrogen by microorganisms living in tree roots.
Symbiosis--coexistence of two organisms.
Tetraploidie--presence of four chromosome sets in cell nucleus.
Threonine--one of the basic amino acids.
Tissue culture--plant cultures obtained by cultivating a single form of tissue.
Tylozine--well known antibiotic in livestock production.

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EAST EUROPE/BIOTECHNOLOGY

# DEVELOPMENTS IN BULGARIAN BIOTECHNOLOGY NOTED

## International Symposium, Exhibit

Sofia TEKHNICHESKO DELO in Bulgarian 21 Jun 86 pp 1, 12

[Article by Engineer Khristo Anchev: "Using nature to conserve nature"; first paragraph is TEKHNICHESKO DELO introduction, last three paragraphs supplied by Dimitur Altunkov who also supplied the photographs]

[Text] Why, with the passing of every day, is the role of technology expanding? The answer to this question may be very long (padded with many arguments and examples), but it may also be short: because the contemporary scientific and technical revolution is, above all, technological. And what technologies are of major significance for our economy? They were outlined quite clearly in the materials of the 13th Congress of the BCP. They are: electronics, biotechnology and technologies associated with the production and application of new materials. The accent will be on them under our new rubric as we present original Bulgarian and foreign developments, as we follow their application in production and as we dwell on their successes and weaknesses on their difficult journey. Of course, the goal that we have set ourselves is to work together for the most rapid and widespread application of these technologies. Maximum achievement of this goal would hardly be possible without your active participation, dear readers; and this time we count on your letters, opinions, suggestions and shared experience.

Biotechnology is the subject that has attracted over 800 scientists and specialists to the F. J. Curie International Palace of Scientists in Varna. The twelve sections covered by the fourth symposium on biotechnology organized by the socialist countries and the first symposium, Laborbio '86 are: recombinant, hybrid, cellular, tissue and enzyme technology, antibiotics and bioproducts for balanced nutrition, embryo transplantation and bioproducts for crop protection, products of elaborate biological synthesis and mineral biotechnology, bioprocesses for conservation of the environment and bioengineering. The non-specialist is hard pressed to choose which of the many rooms to visit, which of the reports to listen to, whether to set aside more time for the posters displayed on the board on the patio, or whether to join the discussions going on in the corridors and the alleys in the park. Hesitating about his choice, he will probably stop in front of some of the exhibits in the foyer. Here, the Laborbio '86 exhibit has been set up. Here

one can see around 50 technical devices for studying, modifying or manipulating processes in the living cell. In another part of the exhibition one's attention is drawn to over 200 new or improved bioproducts. Very often, foreign guests will stop in front of one or another exhibit because the displays illustrate the successes of Bulgaria in the sphere of biotechnology, science and bioengineering.

What is the common thread running through the sessions of the different sections? Not only are scientific presentations made here, but many of the lecturers provide information about concrete achievements, about developments nearing completion and about practical application. The two symposia are dealing with subjects that have been declared strategic in the complex program for scientific and technological progress of the countries of CEMA up to the year 2000. Biotechnology could not have been developed without using the most recent achievements of molecular biology, chemistry, physics, electronics and cybernetics. International meetings such as this are therefore extremely important for multilateral cooperation and reciprocity and for the distribution of labor in the sphere of scientific and technological progress. Taking part in the symposia are not only specialists from the socialist countries but a number of eminent scientists from throughout the entire world. Whereas the fourth symposium on biotechnology is a result of an already established tradition, it is interesting to note what goals the organizers of the first symposium, Laborbio '86, have set. These were best defined in the welcoming address of Professor Ivan Popov, President of the Central Council of the Scientific and Technical Union and Vice President of the Federation of Scientific and Technical Organizations.

The symposium on laboratory equipment for scientific and industrial research, for measurement and control in the sphere of biotechnology is the first step that the Federation of Scientific and Technical Organizations has taken in this direction. With the formation of a standing committee for biotechnology at the Federation of Scientific and Technical Organizations, we shall activate our joint efforts to improve the knowledge, qualifications and creative work of the engineers, scientists and specialists working in this field.

Clearly, direct contact between those who work in the field of biotechnological science and bioengineering will have a favorable effect on the future rapid development of the most recent achievements and their practical application; the more so since, at the fourth symposium on biotechnology and at our first symposium, Laborbio '86, such questions as the creation of technical devices and systems for automation, biotechnological processes and conservation of the environment will be discussed from the point of view of biotechnology, that is using nature to conserve nature.

The okrug company for agrochemical services is an invaluable aid to the cooperative farmers in the okrug of Stara Zagora. By introducing the most up-to-date methods for analysis and development of data, an accurate agrochemical map of the different regions has been drawn up and effective decisions are being taken. An innovation in the work of specialists at the company is the creation of a biofactory for the production of trichogram, a natural bioagent used to combat the pests that plague cabbage and corn.

First photograph: Mariya Stoyanova, a laboratory technician in the agrochemical laboratory is conducting an analysis of microelements in soil samples.

Second photograph: Laboratory technicians from the biofactory, Natasha Kuneva and Tashka Groseva, are preparing extractions in which, given the right conditions, the trichogram eggs will develop.

## Lignocellulose Processing With Bioreactors

Sofia TEKHNICHESKO DELO in Bulgarian 21 Jun 86 p 12

[Article by Professor Khristo Panayotov: "Plant 'cement' -- a source of energy"]

[Text] Lignin is like a cement. It holds together the amorphous elements of plant life. Lignocellulose must be transformed into several products which can replace oil, coal and other natural sources of energy. This can be done with the aid of bioreactors, which are an extension of chemical reactors. But in chemistry the processes are usually completed in a flash, and in an aqueous solution. Since these processes are of very short duration and depend only on a few variables they lend themselves readily to automation. But in the processes in which animate nature participates (plants, microbes, and animal species) the exchange is far more complex and the variables far more numerous. These processes are not only complex but slow. The mechanics and kinetics of interaction cannot be rendered as simple as in chemical reactors and bioreactors are therefore constructed on the basis of a series of principally new solutions.

Fermentation processes in a medium with a high concentration of solid phase are nevertheless used, chiefly for the production of specific food products under anaerobic conditions. These processes produce low yields and use old, stationary technology. Up-to-date, highly developed fermentors for aerobic processes provide the opportunity for automation, optimizing the technological system, but, on the other hand, chiefly in order to satisfy the demand for better mass exchange, a rather low concentration (less than five percent solid phase) is being used. Enormous volumes are required for this. The use of aerobic fermentors with a high content of solid phase (for example fifty percent) is associated with a series of unresolved mass-exchange construction problems. In practice, today, solid phase fermentors are still not in use although, given suitable technical solutions, they have many advantages.

The volume of the fermentor is directly dependent on the capacity of the equipment and the required amount of finished product. As a rule, the larger the concentration of raw material, the smaller the cost of production. In this case, the concentration of product in a unit of volume is of major significance for the evaluation of efficacy of a given construction and type of fermentor. Fermentors that work with a medium density three to five times greater ( 130 to 150 g/L cellular mass) have already been created in foreign countries. The new construction permits considerably greater aeration and heat exchange. The new demands for using some exchange, solid phase, aerobic fermentors pose three major tasks for researchers:

- to create recombinant organisms developing successfully at high density;

- to use a new type of biosynthesizer to study the variables under concrete conditions;

- to construct a new type of high-yield fermentor working with a high concentration of medium and aerobic conditions.

Temperature, relative humidity of the medium, and dynamic coefficient of the air current are the three major exponents that regulate technological processes. It is therefore important to ensure their continuous measurement, along with the pH of the medium. When the heat exchange is achieved with compact construction, the situation is considerably simpler than with conventional exchange fermentors. The most suitable method, which we use, is the regulation of hot and cold air supply.

Similarly, we regulate relative humidity in the fermentor. At the beginning of the process, the air (70 percent moisture) saturates the dry substrate as it reaches high humidity content, but with saturation of the biomass the humidity decreases considerably. In most cases, the reduction of relative humidity at a certain percentage may be an index of the degree of assimilation of the substrate and indicate the end of the process.

As in all aerobic processes, the degree of assimilation of oxygen in the air, is of great importance. In conventional processes, the coefficient of air current for a unit of time and exchange is about one liter per minute. That is an enormous amount of air, for example for 100 cubic meters of ferment, 100 cubic meters of air per minute are required. As we know, oxygen is poorly soluble in water, but in solid phase fermentation the indicated quantity is certainly not sufficient. It must be increased. As our research has shown, the increase must be three times greater and in some cases considerably higher yet. More active use of oxygen is possible as the partial pressure increases (6 to 10 kg per square meter) or as pure oxygen is added.

In our conditions, three types of solid phase fermentors have been constructed and tested: stationary, with an agitator and with a rotating cylinder. These pieces of equipment may be used under different conditions: for laboratory purposes, for small-scale production and for bulky products. Testing of the new types is in the initial stages, and they are about to be improved.

## Main Exhibits Described

Sofia TEKHNICHESKO DELO in Bulgarian 21 Jun 86 p 13

[Article by senior research worker and candidate of technical sciences Engineer Stoyan Kraychev, chief specialist in bio-machine building on the national council for biotechnology of the DKIT; first paragraph TEKHNICHESKO DELO introduction]

[Text] During the sessions at the fourth symposium on biotechnology and the first symposium, Laborbio '86, the exhibits at the exhibition "are resting, unperturbed" by the large number of visitors. Among them, the developments of

the Central Laboratory for Bio-tool making and Automation have a considerable place. Here we can see a model of an automated pilot installation for secondary metabolites, a vibrating mixer, MV-01, and many others. But let us stop longer at the laboratory ferment with the microprocesser regulatory system, ABF 02 M (photograph 1). It is intended for biological research of microbial cultures under laboratory conditions. The microprocessor system regulates the basic variables associated with the culture of microorganisms. The system comprises three functional parts -- EIM, transformer module and power block. On the basis of data from the transmitters and demands recorded in dialogue mode the fermentor maintains the given value of variables or changes them according to selected algorithms. It is possible to print out the protocol for the determination of certain values. In addition to the high functional qualities mentioned, the laboratory fermentor ABR 02 M has an esthetic external appearance. Great interest has been expressed in devices from the USSR, the Hungarian People's Republic, Austria and other countries.

The exhibition, Laborbio '86, is divided into two parts -- equipment for measuring, controlling and manipulating biotechnological processes and products, and new biotechnological production. The successes of Bulgarian bio-tool making and bio-machine building in the sphere of fermentation technology are displayed alongside the achievements of our electronics. The main exhibitors are C O Biotekhnika, Varna; NPSK Desintegrator, Stara Zagora; the Combine for Refrigeration Technology, Sofia; the Combine for Ventilation and Purification Technology, Burgas. The Central Laboratory for Bio Machine Building and Automation and the NPP Scientific Toolmaking at the Bulgarian Academy of Sciences are also participating.

On display are a series of laboratory fermentors with a three-liter capacity and mechanical agitators regulated by constant current electric motors. There are also fermentors with agitators and automatic and semi-automatic regulation. A model of a semi-automatic installation for secondary metabolites, which was developed in Bulgaria, can also be seen. It will be introduced toward the end of 1986. There are television bioanalyzers for antibiotics, disintegration mills, peristaltic pumps. Since refrigeration equipment has great application in biotechnological processes, it also has its place in the exhibition. On display are also devices for measuring the oxygen concentration in wet steam, models of laminar units and sterile rooms (class 100).

The development of part of this equipment has been financed by the DKIT according to the plan for scientific and technological progress, since their introduction is likely by the end of 1986 or, at the latest at the beginning of 1987. Other exhibits are the subject of attention in the complex program for scientific and technological progress of the member countries of CEMA up to the year 2000. According to technological and economic indices and design, the goods displayed are equal to the best world models. The DKIT is closely following their introduction and is promoting these new products. Because without bio-tool making and bio-machine making, we cannot expect rapid development of biotechnology. The exhibition, particularly the fermentation equipment and measuring devices on display, has evoked interest in our guests.

Sofia TEKHNICHESKO DELO in Bulgarian 21 Jun 86 p 13

[Article by Professor Tsanko Stoychev, corresponding member: "On the threshhold of the fourth revolution"]

[Text] One of the basic goals of the Bulgarian Academy of Sciences is to ensure from a scientific point of view the fulfilment of the national program for the development of biotechnology in the People's Republic of Bulgaria during the following five-year plan and up to the year 2000. We know that biotechnology has been designated a strategic area in the cooperation between the member countries of CEMA. We are faced with a difficult question: which biotechnologies to develop?

Which of them will our academic, scientific research activity ensure from a theoretic point of view? In the past decade, there has been an upsurge in the production of antibiotics, enzymes, aminoacids, protein, diagnostic and therapeutic agents, vaccines, etc. These so-called classical biotechnologies, based on classical microbiological research, have not lost their enormous importance. They are and will long continue to be the basis of the biotechnology industry. At the same time, their development requires a solid scientific foundation. We absolutely need to conduct basic research into the physiology, morphology, biochemistry and genetics of microorganisms, producers of biologically active substances.

The production of enzymes occupies a large place in classical biotechnology, used in the food and manufacturing industries, among others, in agriculture and in medicine. I am thinking here of bacteria, yeasts, fungi and actinomycetes. The Institute of Microbiology plays a major role in the development of classical biotechnology for the production and use of bacterial enzymes. The major direction of its research program is in the sphere of microbial hydrolysis. Considerable success has been achieved in isolating highly active bacterial, mold and actinomycetes strains. On the basis of thorough basic and applied research, a series of biotechnological applications for the production of enzymes has been developed and introduced, or is being introduced.

Bulgaria is one of the largest producers and exporters per capita of antibiotics for medical, veterinarian and agricultural purposes. Clearly, future expansion of this production needs a solid scientific foundation. The company Pharmakhim, with its scientific institutions and development bases, is a leading element in this activity. Now, in the Elin Center for Biology at the Bulgarian Academy of Sciences, work is in progress to produce a certain number of antibiotics with antiviral and antifungal activity, and also antibiotics for crop protection.

I must emphasize that, in the past decade, successes in the field of molecular biology, biophysics, genetics, microbiology, enzymology, immunology, cytobiology, organic chemistry and physicochemistry and achievements in the sphere of electronics have created the conditions for development of principally new avant garde biotechnology -- recombinant technologies and

genetic engineering, technologies to produce monoclonal antibodies, tissues, embryonic transplants, etc. These are the biotechnologies of the future. They are extremely science intensive, reduce consumption of energy and materials, and are exceptionally efficient. It is these avant garde technologies that are some of the decisive areas of scientific and technological progress. They are what compels us to talk of a fourth biotechnological scientific and technical revolution.

The achievements of the Institute of Molecular Biology in the research of the structure and functions of the nucleonic acids in chromatin, and the transfer mechanisms of genetic information, have received wide international acclaim. These achievements determine the leading role of the institute in the creation of genetic engineering biotechnologies in our country. We have built some laboratories for the processing and synthesis of DNA, for cellular cultures and a large collection of bacterial strains, plasmoid and bacteriophage vectors. Characteristic of the research and applied work at the institute is the close tie between basic research and its practical application. An effective technology to produce human alpha interferon has been developed from cell cultures. Pharmacology, toxicology and clinical studies are imminent. We have succeeded with a total chemical synthesis of human gamma interferon. And the there are still more developments from this research institute. Not to speak of inventions in the remaining scientific units in our country which specialize in this sphere. In fact, the achievements mentioned are only an illustration of the very wide range of problems, evidence that in the sphere of biotechnologies it is necessary to look for an international division of labor.

Cooperation of the member countries of CEMA in the processing of biotechnology must absolutely direct itself toward agreement and achievement of the program for our own production of the enzymes, chemicals and reactors necessary for scientific research and applied development. With the aid of plant protoplasts and cell cultures we are resolving a series of theoretical problems in genetics and the selection of plant species. The following institutes are participating in fulfilment of the general coordination program of the Bulgarian Academy of Sciences for plant tissue cellular cultures, the Institute of Genetics, the Institute of Molecular Biology, the Institute of Plant Physiology, the Institute of Botany, the Forestry Institute and the Institute of Physiology. The activity of the Laboratory of Plant Cell and Tissue Cultures is supported and expanded within the framework of the Institute of Kinetics, where, in addition to applied development, theoretical and methodological research is being done. Close cooperation has also been established between the Elin Center of Biology and the Agricultural Academy in the sphere of genetic engineering and plant cell and tissue cultures. In our country, the Institute of Biology and Immunology of the Reproduction and Development of Organisms is a pioneer in the processing of biotechnology for zygotic and embryonic transplants, in which animals reproduce in an accelerated fashion and select themselves. Biological potential is exploited to its full extent.

The development of modern biotechnologies is impossible without the creation of modern bioreactor equipment and automation of biotechnological processes. In creating this, the specialists from the Elin Center for Biology have

gradually directed work at the Central Laboratory for bio-tool making and automation. For the goals of control and automation, it is necessary to analyze fully the ongoing biotechnological and microbiological processes, to identify the factors and material-energy balance, to determine the limits and give an account of the opportunities to optimize the biotechnological systems. We may, in fact, go on talking for a long while about the status and future of the research units at the Bulgarian Academy of Sciences that are working in the sphere of biotechnology. But let us not enumerate all the developments. One thing is clear: to be able to guarantee rapid progress in biotechnology, we specialists from the member countries of CEMA must keep each other informed and work closely together on many problems.

[Inset by Assistant Professor Stoyan Tsonkov, Director of the Central Laboratory of Bio-tool making and automation (Bulgarian Academy of Sciences): "Interdisciplinary ambitions"]

[Text] The ambition of our laboratory is to satisfy the needs of the country with biotechnology. We are now creating bioreactors with microprocessor regulation, but we are already moving toward construction of bioreactors for cell cultures, biosensors, automated systems for regulation of biotechnological processes and, in the next few years, toward bioelectronics. Therefore, for us specialists at the Central Laboratory of Bio-tool Making and Automation, this symposium is very useful. Here, to a great extent, we can determine in what direction biotechnology and bio-tool making will develop in the near future.

We work very closely with other institutes of the Bulgarian Academy of Sciences and various departments. But it is very difficult to organize the work of interdisciplinary collectives. Jointly with the chair of biotechnology of the Lenin Higher Machine-Electrical Institute in Sofia, we are working in a combined scientific and academic unit where developments are made and, at the same time, highly qualified personnel are trained. The unit is a prototype of a future technological center in the sphere of biotechnology.

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EAST EUROPE/BIOTECHNOLOGY

# USE OF BIOTECHNOLOGY IN GDR POTATO RESEARCH INSTITUTE

East Berlin FELDWIRTSCHAFT in German No 7, Jul 86 pp 310-312

[Article by Prof Dr D. Kleinhempel, Institute for Potato Research Gross Luesewitz of the Academy of Agricultural Sciences of the GDR: "Where Do We Stand Today in the Application of Biotechnology in Potato Research?]

[Text] New findings and results in the life sciences have raised biotechnical procedures to the rank of key technologies. Organisms that occur freely in nature have long been used for the production of wein, vinegar, beer, cheese and other products.

The large-scale industrial production of antibiotics from microbial liquid cultures also corresponds to traditional biotechnology. Here desired organisms and their metabolic products are enriched in special culture media on the basis of naturally occurring genetic information.

A revolutionary development in biotechnology was introduced through the fact that progress in tissue culture and molecular biology has made it possible to:

--cultivate and propagate plants under in-vitro conditions without harmful organisms being able to exercise a disruptive influence,

--regenerate entire plants from individual plant cells,

--merge and cultivate cells from plants or animals,

--isolate genetic information stored in the nucleic acids of one kind of organism and introduce in other organisms.

The purposeful modification of the genetic program of the cells of microbes, plants and animals--called gene technology--is also opening up totally new possibilities in the area of plant breeding. The in-vitro techniques of cell and tissue culture are already supplementing the traditional breeding.

The culture variety the potato is very amenable to tissue culture and for this reason it has been processed in this connection for some time in many countries.

In-Vitro Propagation

The potato is already being propagated vegetatively in a natural way, so that the possibilities for tissue culture indicated here provide no advantage initially. This advantage does not ensue until the plants can be freed from pathogenic agents under in-vitro conditions and also be propagated under the certain exclusion of these pathogens. In this way, it is possible, for example, to maintain old varieties subject to viruses in gene banks and, when needed, to let open-land plants arise from these in-vitro depots.

Naturally it is not possible to derive the requirement for plant stocks for 100 hectares directly from in-vitro cultures. A traditional propagation is always necessary. For this reason, the tissue culture must be supplemented by up-to-date methods of phytohygiene in field cultivation.

A problem thereby is the transition from the healthy but susceptible in-vitro plant to the plantable potato tuber. In-vitro tuber formation presents improved possibilities here.

This offers the advantage of simplying the storage of potato varieties. Microtubers are stored for 1 to 2 years, depending on the variety, in the refrigerator of the Institute for Potato Research without any need for substantial expenditures on care. If normal plants are to be obtained from this, then greenhouse or sheet-tent cultivation is necessary. Preliminary tests make the direct planting in open land appear promising under certain preconditions. Each microtuber with an initial weight of about 250 mg yielded 300 g of tubers in 1985. That corresponds to a multiplication factor of 1:1,200 in terms of weight.

In-Vitro Resistance Tests

In-vitro depots are also very useful as test sets for the determination of resistance limits (R-genes) against the pathogens of leaf and tuber mold and Phytophtora infestans. They greatly simplify the R-gene determination on breeding material. The first stage of the resistance testing of certain breeding materials is also possible under in-vitro conditions. In a similar manner, the in-vitro establishment of virus stock assortments and resistance testing against biotypes of the pathogen of the potato wart disease leads to rationalization effects.

Anther Culture As an Aid in the Breeding

Another area of application for in-vitro technology is the so-called anther culture. With it, it is possible to obtain dihaploid or monoploid plants from tetraploid potatoes. Whereas the dihaploids can also be obtained from certain crossings with wild potatoes, there are greater difficulties in the case of monoploids. The anther culture can be helpful here.

This technology is based on the fact that the anthers are removed from the still-closed buds of potato plants and put in certain nutrient substrata in sterile culture. From the unripe pollen develop plants with a half set of chromosomes, that is, monoploids result from dihaploids. These spontaneously

double identically, thereby becoming homozygotic and thus very valuable for the purposeful transmission of certain characteristics.

At the Institute for Potato Research, the first descendants from the anther culture are ready for field testing.

To reobtain tetraploid from dihaploid plants, one can carry out certain crossings or induce spontaneous doublings with the help of explantation cultures. Since the two procedures are not identical with respect to the final genetic result, the biotechnological in-vitro method is a valuable supplement in the necessary restoration of the normal tetraploid stage.

Variability in Vitro

In general, the regeneration of plants from single cells leads to certain variations in particular characteristics that, taken by themselves, can also represent a new biotechnological breeding method. With the aid of this so-called somaclonal variation, a search is currently under way for possibilities to improve proven varities to the point where--while maintaining the greatest part of their complex of characteristics--individual valuable qualities can be added. The first 2,000 somaclones are currently being tested at the Gross Luesewitz Institute for Potato Research.

Fusion of Protoplasts

Great possibilities are being opened up by the purposeful fusion of protoplasts to produce desired complexes of characteristics. Protoplasts are cells in which the cell wall has been removed by enzymes and which are able to regenerate back into intact cells and plants. Their fusion is especially important in those cases where natural fertility limits must be overcome. The resulting somatic hybrid plants have the entire complex of characteristics of both initial cells.

Development of Enzyme Techniques

In general, the provision of a larger and larger number of specific enzyme compounds is an essential precondition for the further development of biotechnology.

For this purpose, the Institute for Potato Research successfully tested the means of using phytopathogenic microorganisms that specialize in the enzymatic maceration of the host tissue. Stocks of the bacterium Erwinia carotovora, the pathogen of the soft rot of the potato tubers, have proven especially suitable here.

The advantages of the biotechnological production of enzymes through Erwinia are in a relative uncomplicated procedure, short culture times (24 hours), and the application of an inexpensive complex culture medium composed of mineral salts and derivative products of the potato processing industry. The concentrates containing enzymes can be used very efficiently in the food industry, as, for example, in the extraction of carrot and vegetable juices and for an enzymatic preliminary treatment of fast-cooking legumes.