

Science and Higher Education in Croatia

Report on a visit by the Academia Europaea

7-11 June 2000

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1. Background information

1.1 Reasons for the visit

The Academia Europaea has been invited to conduct an international assessment of Science and Higher Education in Croatia, in order to assist the integration of Croatian R&D with European R&D and the participation of Croatia in the process of European integration.

The invitation was given by the Croatian Parliamentary Sub-committee for Science, Education and Culture (Chairman: Professor Ivo Slaus); the Croatian Academy of Sciences and Arts (President: Professor Ivo Padovan); and the Croatian Chamber of Commerce (President: Dr Nadan Vidosevic; Board Member Dr Zlatan Fröhlich). In preliminary consultations it was decided that a short, early visit should be made by a small group from the Academia Europaea, to provide initial recommendations and to prepare for more focused studies at a later stage. This first visit was undertaken from 7-11 June 2000.

The team from the Academia Europaea was composed of

Professor Sir Arnold Burgen of Cambridge, Pharmacologist, former President of the Academia Europaea and former Foreign Secretary of the Royal Society of London;

Professor Heinz Duddeck of Braunschweig, Civil Engineer, member of the Berlin-Brandenburg Academy;

Professor Inge Jonsson of Stockholm, Professor of Comparative Literature and former Rector of the University of Stockholm and President of the Swedish Royal Academy of Letters, History and Antiquities;

Mr Peter Colyer, Executive Secretary of the Academia Europaea.

1.2 The Academia Europaea

The Academia Europaea is an international, non-governmental association of individual scientists and scholars, aiming to promote learning, education and research. It was founded in 1988 and currently brings together nearly 1900 members from thirty five European countries and eight non-European countries. The Academia's membership covers a wide range of disciplines, including the physical sciences and technology, the biological sciences and medicine, mathematics, the humanities, the social and cognitive sciences, economics and law. The office is located in London and the Academia is registered in the United Kingdom as a charity.

1.3 The Programme of the visit

The main features of the programme were:

7 June 2000	Arrivals and briefing meeting with host organisations
8 June 2000	Visits to: Ministry of Science, Technology and Higher Education Croatian Academy of Sciences and Arts Rudjer Boskovic Institute Croatian Institute of Brain Research The President of the Republic of Croatia

9 June Separate visits by members of the team to:
Viktor Lenac, shipbuilding, Rijeka
Rade Koncar
Inter-university Centre and proposed International University, Dubrovnik
Belupo, pharmaceuticals, Kiprivnica

Team visit to:
Institute for International Studies

10 June Meeting with the Parliamentary Sub-committee for Science, Education
and Culture
Visit to Pliva, pharmaceuticals
De-briefing meeting with host organisations

11 June Departures

2. Overall impressions

2.1 The state of the country

In general the team was positively impressed by the conditions in Croatia. The population appeared to be lively and well dressed and the shops and restaurants were busy. We saw an abundance of new cars and good quality housing. Conditions in the country districts outside Zagreb also appeared to be comfortable and productive. The industrial companies visited showed how much could be achieved within Croatia with a well educated workforce. However, we were aware that visual impressions do not tell the whole story - we were informed that over 20% of the workforce is unemployed and a similar proportion of the population lives below the poverty level. A particular source of economic difficulty is the high ratio of retired persons to productive employees. Nevertheless we are convinced that Croatia has the educational and economic potential to become a fully democratic and prosperous country.

The team also encountered an excessive expectation of outside help and funding. We consider that a greater spirit of self help should be developed, as external agencies are unlikely to provide additional assistance unless they are convinced that the country itself is also doing everything possible to contribute to its own development. Self confidence and self reliance amongst the population of Croatia would itself stimulate a more sympathetic attitude from outside countries.

2.2 Centralised management

Another striking feature was the strong tendency towards centralised management, particularly, as far as the science and education sector is concerned, an excessively powerful role for the Ministry in the planning and implementation of decisions. We were informed that officials in the Ministry take the responsibility not only for broad matters of policy and scientific priorities, but also the allocation of resources at a detailed level and even in individual academic appointments.

This strong centralised system has to be understood against the historical background of earlier systems of self-management ("distributed democracy") which were seen to create their own problems, and the autocratic systems which initially replaced them. However, we have to point out that the role of the Ministry in scientific and academic detail is far stronger than in other western European countries. This means not only additional bureaucratic requirements but also the possibility of political interference which, though possibly well-meaning, eventually has an adverse effect on academic and scientific freedom.

The broad consensus in western European countries is that Government needs to create an intermediate level of management between itself and the academic/scientific sector. This ensures that decisions about the distribution of resources, scientific programmes, academic manpower requirements, etc., are taken by those closer to the problems and without political influence of the wrong kind. The team has identified the need for an intermediate tier of academic/scientific management as a priority for further specialist advice. This matter needs urgent attention as the country adjusts to the results of the elections in early 2000.

3. Reports on items in the team programme

3.1 The University of Zagreb

One of the main actors in Croatian research and higher education policy is of course the University of Zagreb. For several decades it has suffered because of disagreements about its organisational structure, particularly its relationship with the Ministry of Science and Technology. At the time of our visit this conflict had a rather curious character as the present rector, Professor Branko Jeren, was himself a few years ago head of the Ministry, and in that capacity he devoted much energy to the same kind of detailed ministerial steering of the university as he is now ferociously fighting against. This also illustrates both how small the circle of political agents seems to be in Croatia and how many university professors you meet among them.

It is obvious to the Academia team that the University of Zagreb desperately needs to be changed in many respects. Today it is a conglomerate of over 30 faculties and academies of arts, which has no common vision, not even a mission statement which should be the minimum requirement for a modern university. The distribution of money directly from the Ministry to the faculties deprives the central decision making and executive organs (the Senate and the Rectorate) of all real means to take the responsibilities which they have according to the statutes. The present structure, which has few, if any, parallels in Europe, has led to a great amount of duplication and high extra costs. There is very little co-operation between the faculties in research, in teaching, and even in such simple administrative matters as purchasing of goods. The faculties were described to us as "almost small universities".

Even more serious, this form of organisation hinders any renewal of its programmes, which is essential in a modern educational and research system. The fact that professors are paid according to the number of courses they give has led to the unsurprising result that the students spend far too much time listening to lectures (or are at least expected to do so). There seems to be no discussion of programme reforms in order to replace the present focusing on teaching by various techniques of stimulating learning, as is the case in many European universities. Students seem to have little real influence on their conditions, and the drop-out rate is very high, at least in some of the biggest faculties.

The University of Zagreb is very large (60,000+ students and 10,000 staff) and it is spread over the whole city. It is understandable if some politicians would be prepared to split it up into smaller units, and this is allegedly under discussion at the Ministry. In our view it would be most unfortunate, as well as out of line with present trends in Europe at large, to separate the hard sciences from the humanities in a broad sense. The traditional idea of a "universal" university, such as exists at the University of Zagreb, is still very attractive, but it has to be adjusted to the needs of a modern society. The fundamental weaknesses of the university cannot be helped by a policy of dividing it into smaller units but must be attacked from other angles. No doubt some faculties are over-staffed, and both the position of the individual professors and the way they are paid seems to be outdated. A personnel policy should be installed, permitting chairs to be transferred between departments when becoming vacant; the high average age of the teaching staff makes long-term planning an immediate need. This might give opportunities to reduce the number of both students and staff in combination with radical changes in the organisation but

without splitting up the university. The most important reform would be to stop the Ministry's interference with matters of the university and install a funding system in which the autonomous university would be given a lump-sum to be distributed by the Senate according to transparent criteria.

However, such a new order must be combined with reforms of the internal structure of the university. In its present shape, the Senate, consisting of more than 40 members including all the faculty deans, cannot be expected to function properly as an organ where budget decisions can be taken, nor as a body for strategic planning. The legal status of the faculties must be changed, so that they become subordinate to the central university authorities. We also recommend that the number of faculties should be radically reduced (see comments by Professor Duddeck below for specific examples), and that faculties should not be allowed to establish departments independently. At present there are said to be at least 10 departments of mathematics, which do not co-operate. We believe that there is a strong will not only by the Rector but also by a group of responsible professors to put through these and other necessary changes, and these aims should be supported.

In addition there should also be established an independent Research Council with a majority of active researchers to distribute grants to projects on the basis of applications. Substantial allocations for a longer period of time, 3-5 years, should replace the present system of often ridiculously small amounts of money evenly distributed to almost all professors by the Ministry on obscure grounds.

Comments by Professor Duddeck relating specifically to technology

Of the 30+ faculties and academies of art, twelve are technical or technology oriented. By international standards some cover rather small fields, such as Traffic Engineering, Geodesy, Geotechnics, Textile Technology. In German Technical Universities the first three of these are fully integrated in the Faculty of Civil Engineering.

The almost complete autonomy of the faculties has resulted in independent professorships for service functions such as Mathematics, Physics, Information Technology, Economics, Social Sciences etc. The "unified process of teaching and research", as a principle claimed by the University is severely infringed in these cases.

Recommendations:

(1) Some of the faculties existing at present should be merged, for example Traffic Engineering in Mechanical and Civil Engineering, Geotechnics and Geodesy in Civil Engineering, Textile Technology in Mechanical Engineering.

(2) Almost all engineering professions are integral disciplines of a trans-faculty nature, and will become even more so in the future. In order to provide students with new developments in all fields, the service disciplines such as Mathematics, Physics, Chemistry, Computer Sciences, Economics, Social Sciences etc. should be taught by professors of the relevant faculties. The corresponding within-faculty professorships should be abandoned.

(3) The Ministry and the University should consider whether professors may be encouraged to work together with industry, even encouraged to undertake consultancy work in order to transfer new knowledge. In some of the disciplines the work on diploma-level and doctoral theses may be conducted in co-operation with industry.

(4) The splitting of the University into two almost equal institutions is not recommended. However, considering the 60 000+ Students, the large number of faculty members, the restricted resources for research facilities and the large percentage of student drop outs, a possible remedy might be the creation of an integrated University/Technical College Institution. The faculties of technical sciences might be reconstructed by offering students:

Either a technical college education of three years academic education and an additional one or two semesters of practice in industry (the model could be the German Fachhochschule);

Or a five years University study equivalent to the masters degree or the German Diplom-Ingenieur.

(5) The links between the University and industry and vice versa should be strengthened. For this purpose the Ministry could establish special research institutes engaged in the industrial development of new technologies as e.g. the Koncar Institute would like to do. The financing should be provided to a greater part by the state and, as long as the profit margins of the industry are low, to a lesser degree by the industry. The Fraunhofer-Gesellschaft in Germany may be a model for this. If emphasis is placed on modern light industry (e.g. Information Technology, Electronics, new energy sources etc.) the financial needs for equipment may not be very large.

3.2 The Croatian Academy of Sciences and Arts

The Academia team was impressed by the magnificent building now restored to the Croatian Academy, and particularly by the invaluable art collection which could probably be better known and appreciated. The Academy has an extensive publishing programme. In general, however, the level of activity appeared to be small. The Academy seems to have greater flexibility than some other parts of the Croatian academic system in deciding the application of its government grant, though the examples of how this flexibility had been used were not numerous. We would like the Academy to become more adventurous in its promotion of new and original scientific themes in Croatia.

3.3 Rudjer Boskovic Institute

This well known institute gave the impression of having fallen on hard times. After discussion with the senior staff the time available for inspecting the facilities was rather short, but we did see parts of Chemistry and Physics which were formerly the leading parts of the institute; the impression was depressing. They seem to have decrepit old equipment and housing. The genetics department was better and was doing modern work, although probably not very original. We were struck by the emptiness: so few people were in the labs and these not very actively employed. The Institute has been seeking to become part of the university, perhaps to improve funding. The contrast with the Institute of Brain Research was stark.

The Rudjer Boskovic Institute is a crucial element in Croatian R&D policy both because of the wide range of its work and its past prestigious status, which continues in at least some of its fields. The time available to the team did not permit a thorough analysis of the best way forward, but several possible alternatives were discussed, including:

- integrating the Institute with the University of Zagreb;
- linking the Institute with other research institutes in Croatia to form a national association, modelled, for example, on the Max Planck or Fraunhofer systems in Germany. The institutes in the association would be funded partly from the Ministry, partly from the region in which each institute was located, and partly by commissioned research from public or private customers;
- closure of some lines of research;
- a combination of the above.

Attention to this issue is urgently required - see "Issues for further studies" in section 6 below.

3.4 Institute for Brain Research

The Institute is part of the Medical School and its Director, Ivica Kostovic, is also Professor of Anatomy and Neuroscience. It is housed in a large new building of Stalinesque design and is well equipped. Kostovic has been trained in the US and has set up close association with two distinguished Croatian émigrè, scientists, Pasko Rakic at Yale and Kresimir Krnjevic at McGill, with a lot of joint activity. The research is a mixture of rather old-fashioned classical anatomy and pathology involving a bank of brain specimens and more up to date morphological and

cytological work: there appears to be no electrophysiology. There is co-operation with clinical departments partly through a jointly operated NMR scanner and there is reputed to be cooperation also elsewhere in the medical school. The firm leadership given by Professor Kostovic is reflected in the high proportion of publications bearing his name - the more junior scientists should be encouraged towards the independent development of their careers.

3.5 Institute for International Studies

The existence of this Institute, and particularly its earlier concentration on African studies, is due to an accident of planning in the former Yugoslavia, when an institute was formed in each region of the country to conduct international studies relating to different parts of the world. The Institute is now working on developmental issues more generally and, in particular, on studies of European integration. The team agrees with this development, and considers that the work of the Institute will become of increasing social and political importance.

3.6 Pliva

Pliva is a well established pharmaceutical company that has had a new agent research programme for many years. It has had a program on antibacterials that has produced an important major agent that has been patented and jointly developed with Pfizer. This has provided the finance for the renewal of plant that is currently in process. Pliva has recruited high level senior staff from abroad starting two years ago and is now a quoted company in London and Frankfurt. The state pension fund had a major holding which is now reduced to 25%. There is no doubt in this case that the company is firmly under the control of its independent (?) directors. The financial transactions with the pension fund are obscure, but presumably it received a good price for its shares and has an income stream resulting from the company's successful trading. By the standards of the industry it is a small player and wisely is seeking to be a niche player in anti-infective and anti-inflammatory agents. If it continues to thrive and produces successful new drugs, it will be a target for take-over.

4. Report by team members on individual parts of the visit

4.1 Professor Sir Arnold Burgen

Belupo

Belupo is a pharmaceutical company in Koprivnica, a small town in the north of the country which is essentially a company town of Podravka, a food processing company of which Belupo is a subsidiary. It was established in 1971 and is essentially a pharmaceuticals company processing generics (non-patented) and drugs licensed from Western European and US sources. In some cases it produces the ingredients, but mainly seems to buy in the bulk drugs. It has grown rapidly, reaching a turnover of 150 million DM in 1995 and is forecast to grow by 10% annually. It has recently opened a splendid new building which is excellently equipped and has room for considerable growth. It exports to East and Central Europe, the areas for which it has licensing agreements. There is no R&D facility and no intention to create one. It is difficult to assess the financial status of the company without budget figures but it should be a good earner. The company also makes and sells cosmetics, but this seems a small part of the business. The new building and equipment have been largely financed by a loan from the state pension fund; it was not at all clear what the repayment terms are and whether the pension fund controls the company and receives profits from it. Its expansion out of the current region it serves will be limited if it does not enter into a R&D program.

4.2 Professor Heinz Duddeck

4.2.1 Victor Lenac shipyard, Rijeka

I was accompanied by Professor Bozidar Liscic. We met Sales Manager Pajdas, Director Vrhovnik and Deputy Director Antunac.

The main activities of the shipyard are ship conversions, ship repair and off shore structures (for the Ivana gas fields). The privatised stock market company (35 % Italian) has revenues (in 1999) of 350M Kunas, 90% in the international Mediterranean market. The workforce consists of 900 employees (10 years ago:1800), 200 of whom are engineers, average monthly income 4700 Kunas (1200 DM). Recently a 30M USD credit has been won from financial institutions of the USA, Germany and Austria in order to expand the facilities. Most of the construction work is developed by AGIP, the Italian partly owner. Software is bought abroad.

Analysis of the visit:

- (1) The company has an excellent management, good engineers and is oriented to international standards and know-how. The engineers and directors are enthusiastic and good professionals.
- (2) The engineers are well educated for their direct engineering work. However, the University does not provide sufficient preparation in project management, economics and legal processes.
- (3) Investment money comes from abroad not from any sources of Croatia.
- (4) The company relies too much on know-how from other countries. There is (because of the lack of financial resources) no development department and too few possibilities for training the employees abroad.
- (5) There is almost no transfer flow of knowledge from the Universities of Croatia to the company. Professors are neither involved in consulting nor asking for problems for student theses, although there is a Faculty of Engineering and Naval Architecture at the University of Zagreb. Laser welding is not used at present. The annual report does not mention any support by Croatian research institutions.

4.2.2 Koncar Electrical Engineering Institute. Zagreb

The institute has been financially independent since 1991, although still belonging to the holding Rade Koncar. The main activities of the 13 laboratories working on customers' requests related to electrical utilities, type tests, monitoring, consulting, and the certification of products (e.g. for Croatian Railways) are: electronics and rotating machines (24%), switching devices (15%), testing and certification (14%), transformers (13 %) and insulating materials (13 %). Out of the total revenues of 25M Kunas (in 1999), 13M are earned from Rade Koncar, 2M from exports and only 1.2M from Ministry of Science and Technology. The number of employees is 125 (10 years ago: 1100), 20 of whom have a doctor's or master's degree and 50 a bachelor's degree.

Analysis of the visit

- (1) The members of the institute convey very good professional quality and a high spirit of engagement.
- (2) The directors are more concerned with winning contracts than with strategies of future research and development: "We live only from day to day."
- (3) Although the institute claims to be a research organisation, the work done mostly applies known technologies and methods. The institute has to react to customers' needs on short term contracts and cannot offer new developments by its own research. There are no financial resources for long range perspectives. Thus, the institute may "lose its future".
- (4) Co-operations with the Faculty of Electrical Engineering and Computing are rare, except with those Professors who came from Koncar. The University ties were much closer 10 years ago. Students are not employed, nor do they co-operate with the institute on problems for their diploma or doctoral theses.
- (5) Young engineers cannot be sent abroad for training or further education, not even for conferences, because of financial shortages, although there are some connections to foreign companies like Siemens.

(6) The institute does not, at present, apply for research and development money, as e.g. within the 5th Framework Programme of the European Union, although the Institute for International Relations (IMO) offers help in preparing applications.

4.3 Professor Inge Jonsson

The International University in Dubrovnik

When it comes to the plans for an international university in Dubrovnik, I would very much like to support them, if there were any chances to make them become real. There is no doubt that the place is extremely well suited for profound studies of the tragic history of the Balkan region as well as for peace research, since the Inter-University Centre has almost thirty years of experience of arranging international and interdisciplinary courses and the archives of the city are full of interesting documents. However, I do not find it possible that any European foundations would contribute financially unless Croatia itself makes a start. Fair or not, I think that you have to take into consideration the widespread suspicion against the peoples of the Balkans and their ability to keep peace and order among themselves. But I also believe that the project deserves moral support, and maybe a presentation of it in the Academia's Newsletter *The Tree* could be a first step. I intend to talk to people in the Swedish research foundations about the would-be Dubrovnik International University.

5. Reporting to the Croatian authorities

During the visit, the team was given an audience by the President of the Croatian republic, President Mesic. The team was able to present some preliminary results of its interviews, and the President indicated his aims and support for Croatian science.

The team also reported to the Parliamentary Subcommittee for Science, Education and Culture, leading to an open and constructive exchange of views with several members of the Subcommittee. The Academia expects the Subcommittee to have a most important role in ensuring the changes necessary as a result of the international assessment of Croatian R&D.

6. Issues for further studies

The team from the Academia Europaea has identified the following issues which should be examined in greater detail by further experts from Western Europe. The Academia is ready to assist with these tasks if the modest amount of funding required can be provided. It is not proposed that a large team should visit Croatia to handle these matters simultaneously. Each of the following items could be handled by just one or two expert visitors; for organisational reasons it would be more beneficial to spread these visits over a series of months than to concentrate them in a single brief period.

1. The legal structure of Croatia and the European Union. Concern was expressed to us that Croatia will face difficulties in its attempts to join the European Union because of fundamental differences of legal structure. An expert in international law could advise on this matter.

2. The need for decentralised mechanism for handling public expenditures on research and education. As noted in the preceding report, all Western European countries have realised the need for an intermediate level of management between the political process and the scientific/academic sector. A member of the Academia experienced in these fields could advise.

3. The structure of the University. A major overhaul of the legal position and the administrative structure of the University of Zagreb and its faculties is urgently required. The Academia will need to liaise carefully with CRE over this matter to ensure that consistent advice is made available.

4. Relationships between the University and industry Any sense of mutual responsibility or benefit between the university and industry in Croatia seemed to be noticeably missing. Advice could be given on the successful fostering of interdependency between the academic and industrial sectors.

5. The organisation of the research institutes At present the research institutes in Croatia are individually related to the Ministry. Should they be transferred to university administration? Or grouped into a single structure? Or is a piecemeal approach necessary? During the team's visit, the possible models of Germany's Max Planck or Fraunhofer Institutes in Germany were quoted as possible ways forward. Advice could be given on the future orientation of the institutes.

6. The role of the Academy. In many countries the role of the national Academy has faced uncertainty, as the control of research institutes has been passed to other institutions and the need for this type of national body has been questioned. The Croatian Academy is no exception, in that it appears to suffer from a deficiency of activities and targets. Advice could be given from the experience of other European academies.

7. A place for innovation. The team's experience indicated that several aspects of the current systems in Croatia operate against the emergence of new ideas in education and research. The reforms proposed above will help to correct the situation in the necessary directions, thus releasing inventiveness and originality. Additionally, advice could be given on possible mechanisms to encourage the emergence of innovative thinking in the academic and scientific sectors.

The Academia Europaea will explore with the authorities in Croatia the opportunities for visits related to the above themes, and their preferred timing.

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