

Science in the crucible

Belgrade

SCIENCE in Yugoslavia is emerging from a period of chronic underinvestment and mismanagement. The picture is changing but there is a widely shared feeling that this is a period of transition with a great many uncertainties still to be confronted.

"The old structure is like a dissolved crystal," says Dr Vladimir Glisen, head of the new Genetic Engineering Centre in Belgrade. "It will recrystallize, but into what?"

According to Professor Branislav Jankovic, of the Institute for Immunology and Virology in Belgrade, "everything is in the crucible".

This is borne out by puzzling contrasts between some research groups who find it hard to buy journals, books and everyday research materials, and others who have the very latest equipment and say they have no complaints.

The common denominator is a chronic lack of state basic research money combined with a complete switch from federal funding to funding by the individual republics in the 1970s. On the whole, the 'have-nots' are in university faculties, where research is seen as a sideline, and mathematics receives the same level of support as biology, while the 'haves' are in research institutes, and have developed links with industry or contacts with foreign laboratories. Added to these critical factors is the ideologically promising, but practically unworkable principle of self-management applied to research.

Yugoslavia has suffered unbridled economic recession and inflation for over a decade and this has been both a cause and a consequence of the malaise in science.

During the 1970s oil crisis no steps were taken to offset potential long-term economic effects. Industry remained energy-intensive, while foreign loans produced a false sense of well-being that was to be shattered in the 1980s. Instead of investing in home-grown talent, industry bought foreign technology and used it to produce goods largely for the domestic market. This created a widening gap in the balance of payments, an industrial base that was losing touch with market forces, and research almost completely divorced from economic needs.

Reforms introduced in the late 1970s, aimed to strengthen the ties between scientific research and the needs of industry, backfired.

After years of highly centralized federal research funding, responsibility was handed to the individual republics. Within each republic, science has been organized by amorphous "self-management communities of interest" (SCI's) — essentially hierarchies of committees

representing, on the one hand, the producers of research (scientists) and, on the other hand, the 'users' (industry).

The SCI's decide which projects are funded and at what rates. But in practice, according to almost ubiquitous experience, there is very little selection and grants are said by some critics to reflect the number of staff, or personal connections, as much as scientific merit.

Meanwhile, decentralization meant that federal structures disappeared. Now there is no federal 'ministry' for science — and consequently, no global budget, although very new reforms are changing this.

At the same time the richer republics, each wanting to have the best, have duplicated facilities.

YUGOSLAVIA

Population: 23.41 million
 Area: 255,804 sq. km
 Per capita GNP: \$2,300
 Higher education: 326 institutes of higher education.
 Total no. of students: 349,654.



"Leaving the people with no state help was disastrous," says Professor Vlastimir Matejic, director of science at Belgrade's Mihajlo Pupin Institute and advisor to the 1988 Organisation for Economic Co-operation and Development (OECD) review of science policy in Yugoslavia, "this has led to a typical feudalization of the system".

While there are several first class laboratories and institutes throughout Yugoslavia, the delegation of power to the republics has created what Matejic calls "negative synergy". Now, overcoming inter-republic competition to create a sufficient 'critical mass' for effective science is, he says, "the next battle to be lost or won".

One long-term consequence of the self-

management system was that the university faculties effectively stopped carrying out research.

Teaching is handled by separate "self-management communities of interest", with their own, meagre funds — the take-home pay for a senior professor is less than \$600 per month.

Now, only about 28 per cent of research is carried out in the universities, partly because of long-term hardship, partly through inertia.

By far the greatest research potential (50 per cent) is in so-called independent institutes. In addition to four large research institutes set up shortly after the war (the Mihajlo Pupin and the Boris Kidric Institutes in Belgrade, the Ruder Boskovic Institute in Zagreb and the Jozef Stefan Institute in Ljubljana), a few highly motivated university staff created their own research institutes in order to be eligible for grants and to tap industrial development funds.

But this has often meant accepting contract work and some institutes are even involved in manufacture. So, a dynamic robotics laboratory at the Josef Stefan Institute makes and sells robots and rehabilitation aids.

Similarly, Zoran Janevski's team at the Institute for Theoretical Physics, near Belgrade, makes lasers. At the other end of the spectrum, and to add to the confusion, some enterprises, such as the major pharmaceutical "companies" ("organizations of associated labour") — Galenika, Pliva and Krka — have their own research institutes and train PhD students, while senior research staff lecture at the university faculties.

Within this system there are nevertheless several top-rate laboratories, despite a significant brain drain. Some of them even manage to carry out basic research.

How is this done? The answer, very often, is a combination of foreign connections, good commercial sense and, as Vladimir Glisen has put it, "learning how the system operates". **P.C.**

International cooperation

The self-management communities of interest (SCI's) provided only about one third of research funds during the 1970s and 1980s, with the balance coming through enterprise and research organization exchanges.

As a result, agreements between Yugoslavia and foreign countries have played a significant role. The sums involved are modest, but the number of projects supported is considerable, as Blazo Krstajic, Assistant Director of the Federal Institute for International, Scientific, Educational, Cultural and Technical Cooperation in Belgrade, explained.

The major bilateral agreement is with

the USA, and started some thirty years ago when the US ploughed non-convertible dinars from trade deals back into research exchange. Today the US is a partner in 350 projects, worth \$2 million. Although the arrangements are bilateral, says Krstajic, the flow of exchange is mostly one-way. National Science Foundation training scholarships and post-doctoral programmes also allow 'bridges' to be built with US laboratories. A more exceptional case is that of Radimir Crkvenjakov, of the new Belgrade University Genetic Engineering Centre. His novel approach to DNA sequencing earned him the first US Department of