

ably. The Office of Science and Technology and NASA seem both to have been far from pessimistic about the present position.

With the object of giving Federal laboratories a greater sense of participation in scientific policy making, the sub-committee argues that ways should be found of letting the heads of laboratories function more effectively outside their immediate parishes. Although witnesses before the sub-committee seem to have been entirely in agreement with the objective, opinions differ as to the best way of achieving this. Dr W. Astin, chairman of the laboratory committee of the Federal Council on Science and Technology, urged that there should be more regular councils of laboratory heads within the separate agencies of government, and this is the solution which the sub-committee seems to favour. Other people, Dr Alvin Weinberg, for example, want to see laboratory directors more involved in the work of advisory committees such as the Federal Council itself and the President's Science Advisory Committee.

The sub-committee's views on the need to carry out systematic appraisals of the work of the Federal laboratories are understandably somewhat nebulous. It is convinced that something should be done, but not quite sure who should do it or how it should be done. Agency departments such as the AEC and the Department of Defense claim to have internal methods of appraising the work of their laboratories, but these necessarily rely on inspection by groups of experts appointed from within. Only rarely is it possible to apply objective yardsticks to the problem of appraisal—for example, when contracts have been let externally to civilian laboratories or when it is possible to apply objective criteria such as PERT. On the whole, the sub-committee in its report leaves the impression that it would like to see the Federal Government be more systematic about appraisal and that it would like to see the Bureau of the Budget and the Office of Science and Technology between them undertake the job.

BUSINESS

Precocious Managers

AMERICAN business success is so diverse a phenomenon that it is hard to find simple explanations for it. Recently it has been fashionable to suggest that sheer size has much to do with it, and many British companies are busily merging in order to cash in on the supposed advantages. But the United States also has very successful middle-sized businesses (in, for example, the chemical plant industry) and a plethora of small companies, many of them in the areas of advanced technology which are supposed to be reserved for the giants. It was of this last group that Professor Edward Roberts of MIT spoke when he addressed a meeting at the United States Embassy in London on "Technical Entrepreneurship".

Professor Roberts and his colleagues have carried out a study of 200 small companies started by scientists from four MIT labs, industry, an Air Force laboratory and the Mitre Corporation, a not-for-profit organization. With a few exceptions (like the emeritus professor who started his company after retiring from his chair) the entrepreneurs are young men, between 32 and 35 at the time their companies were launched. Most have master's degrees rather than doctorates, and most have

worked in development rather than pure research laboratories. Some of the scientists who started their own businesses seem to have been predisposed to it by their family backgrounds; 50 per cent reported that their fathers had been self-employed. There were also characteristic personality factors. The better entrepreneurs showed through personality testing that they possessed a high "need for achievement" but only a moderate need for power. The less successful tended to want power rather more strongly than achievement. Professor Roberts interprets this as suggesting that the power seekers are less successful because of their tendency to authoritarianism, which drives others out.

One of the crucial factors in the success of these companies is the amount of "technology transfer" which can be achieved between the laboratory and the business. Scientists who went straight into business from the laboratory—often starting their businesses while still drawing their laboratory salaries—were much more likely to succeed than those who delayed. Some of the scientists joined other firms for a short time, to get experience before starting their own businesses, but this seems to have been the wrong strategy. "Fledgling companies have no other advantage except for advanced technology", Professor Roberts commented; "when they use it, they win out". But the more successful companies did have marketing departments, suggesting that even a better mousetrap needs selling.

More often than not, the small companies were launched on a Government contract, and much seems to have depended on the good personal relations between the man starting the business and the people responsible for awarding defence contracts. This suggests that research contracts in the United States are awarded on a much less tightly organized basis than in Britain. As Mr Michael Shanks of British Leyland Motor Corporation suggested in the discussion, the American Administration "does not have the same stuffy attitude to public procurement as the British Government".

Professor Roberts has also extended his studies to include large companies, with revealing results. Using exactly the same methods, he studied sixteen new ventures undertaken by a large American firm in the communications and electronics business. The men identified as the entrepreneurs in these sixteen examples bore remarkable similarities to those scientists who had started their own companies. But, unlike them, the entrepreneurs within the big companies had been comparatively unsuccessful—only two of the ventures had been undoubted successes. Two were still in doubt at the time of the study, and the rest were dismal failures. Large corporations, Professor Roberts concludes, "are systematically biased against youth". To get away from this stifling situation, companies would have to adopt less rigid organizational structures, and be prepared to provide rewards to entrepreneurs directly related to their actual performance. The setting up of "new venture" divisions outside the immediate influence of the parent organization would also help. Within large corporations, an elder statesman (presumably too old to be an entrepreneur himself) should be responsible for encouraging innovation, taking the same role as the professor in a laboratory. This suggestion, at least, gave most of Professor Roberts's audience, too old for entrepreneurship themselves, a role with which they could identify.