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What does marine biological research cost? A case history of 25 years at a university research station

R. L. Haedrich

Memorial University of Newfoundland; St. John's, Newfoundland A1B 5S7 Canada

ABSTRACT: A study of research funding at Memorial University's Marine Sciences Research Laboratory shows that true costs far exceed support from grants and contracts alone. Research grant levels have to be matched by a similar level of support for infrastructure, and other university-supplied support (mostly salaries) may amount to twice that supplied by grants. Faced with declining external support for general infrastructure, universities can ill afford to become involved in scientific mega-projects. There is little evidence that increased funding enhances productivity.

INTRODUCTION

Education and research within a university are so intertwined that it is hard to identify and clearly allocate individual costs. Budgets for formal teaching, and related matters, always overshadow that explicitly for research, and, in practice, research is often "piggy-backed" as a part of the general teaching budget. The question becomes even more difficult when indirect costs are considered.

In the changing world of research funding, the question of the true cost of university-based research becomes more than academic. Increasingly, research programmes of all kinds are becoming complex, interdisciplinary, and large. This situation is especially true in the marine sciences, with well-known examples to be found in the U.S., Norway, Great Britain, Germany, the European Community generally, and Canada. What are the real costs? Can universities afford to get involved in such programmes?

The Marine Sciences Research Laboratory (MSRL) of Memorial University was built in 1967. The brainchild of Dr. F. A. Aldrich, who was strongly influenced by his own experiences at the Marine Biological Laboratory in Woods Hole, it was set up and conceived of in the usual style of a university research station. Located on the rocky, open coast only 8 km from the main campus, it served the teaching and mainly summer research needs of the Biology Department of which it was a part. Marine ecology was the primary focus.

In 1972, a second building for work on fish physiology was added, and the Laboratory was reorganised as an autonomous research facility with the prosecution of marine research as its only responsibility. The Lab offered no courses and had little campus involvement, but was left with the freedom to develop on its own into a national and international research centre. The budget came directly from the university president rather than through a teaching department. Investigators at the Lab applied for external grants and contracts to support their individual research programmes.

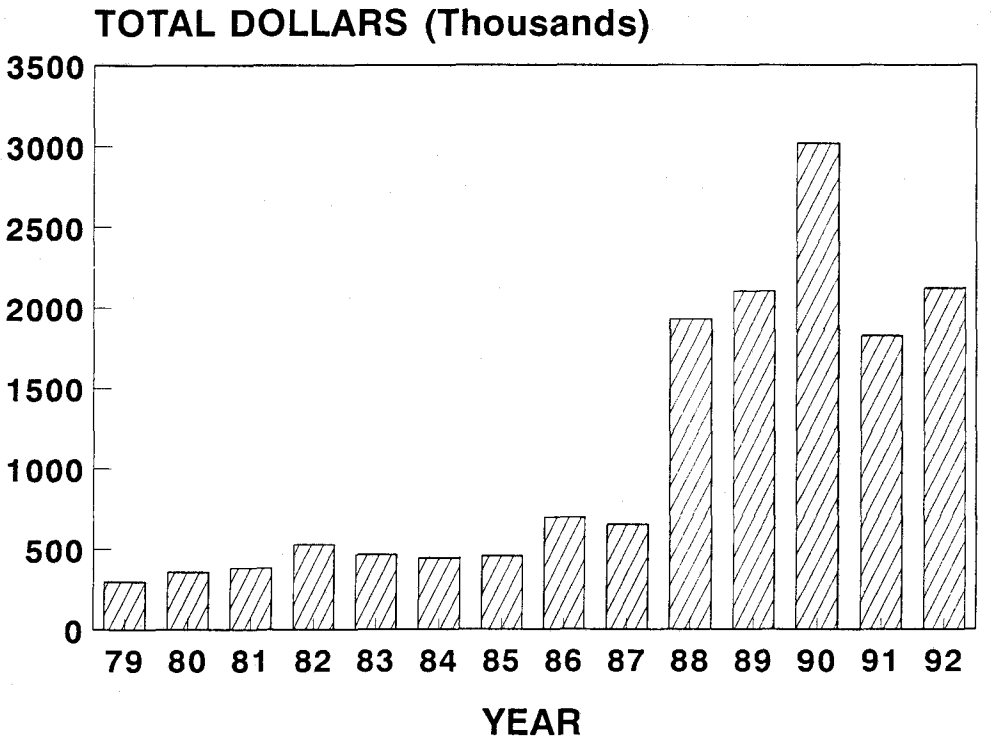

Fig. 1. Grant and contract funding for ocean sciences at Memorial University for the years 1979 to 1992. Nominal Canadian dollars

Because the entire budget of the Laboratory (including all indirect costs) was for the support of research, a study of the funding-history of the MSRL offers an unusual opportunity to see what the real costs are for a university-based marine research facility of this kind. Grants and contracts have increased dramatically since 1985, in a pattern of growth that any Director would be happy to boast of (Fig. 1). It would seem that the picture is a rosy one – but is it? We shall see.

MATERIALS AND METHODS

The data on finances were sorted out when I was Director of the MSRL, and later of its expanded successor, the Ocean Sciences Centre (OSC). Many of the figures appeared in annual reports of the President, and are summarized here in Table 1. Data for the 1970's are somewhat incomplete; therefore only information since 1979 is reported. In 1988, the MSRL was united with the Newfoundland Institute for Cold Ocean Science (NICOS) to form the OSC. Funding shown for the period prior to 1988 is for MSRL alone, but from 1988 on it is for the larger OSC.

Grants and contracts come mostly from the Natural Sciences and Engineering Research Council (NSERC). This important agency is the primary source of university

Table 1. Funding for ocean sciences at Memorial University by major source for 1979–92. Nominal Canadian dollars

Year	Grants/Contracts	Infrastructure	University
1979	$ 296 290	$ 439 978	$ 782 000
1980	356 023	423 063	845 000
1981	380 988	443 887	940 000
1982	526 801	423 110	1 014 425
1983	463 800	468 830	1 005 000
1984	442 017	473 594	926 000
1985	453 939	445 502	1 111 000
1986	695 000	445 502	1 188 000
1987	650 896	250 000	1 214 000
1988	1 926 753	250 000	1 430 000
1989	2 100 161	250 000	1 617 000
1990	3 016 957	250 000	1 756 957
1991	1 822 787	250 000	1 583 000
1992	2 118 027	243 000	1 225 086

research funding in Canada. NSERC has its own unique character – for example it does not fund salaries of principal investigators (the university is expected to do this) – but in general its rules and practices are not too different from those of most national funding agencies.

Infrastructure funding is from NSERC and the Federal Department of Fisheries & Oceans (DFO). This money is used for salaries of support staff (including divers and other general technicians), maintenance and improvement of common facilities such as holding tanks, and operation of small boats and the like. In 1987, infrastructure support from DFO ended, leaving NSERC as the sole supplier of this important funding base.

University support includes salaries of scientists, some research assistants, administration, capital equipment, lab materials and supplies, communications, vans, custodians, general maintenance and repairs, and shop services. Heat, light, and major construction or repair are covered separately by University Works and Technical Services, and do not appear in the budget figures of Table 1. At present, University Works and Technical Services spend approximately $ 700 000 each year on OSC.

RESULTS AND DISCUSSION

In the early years of the MSRL, funding was marked by large infusions of university money but little grant support. By 1979, however, the funding had settled down to a rather stable pattern which continued until 1987 (Fig. 2). Important in this funding pattern was external support for infrastructure which was about equal to the level of that from external grants and contracts. Even more important was the contribution from the university, at a level approximately twice that of the grants and contracts.

The years from the late 1970's to 1987 mark the period when MSRL established itself as a significant research player on the Canadian university stage. To accomplish this took levels of funding approximately four times the amount generated by research grants and contracts alone, including allocated infrastructure funding about equal to that of grant

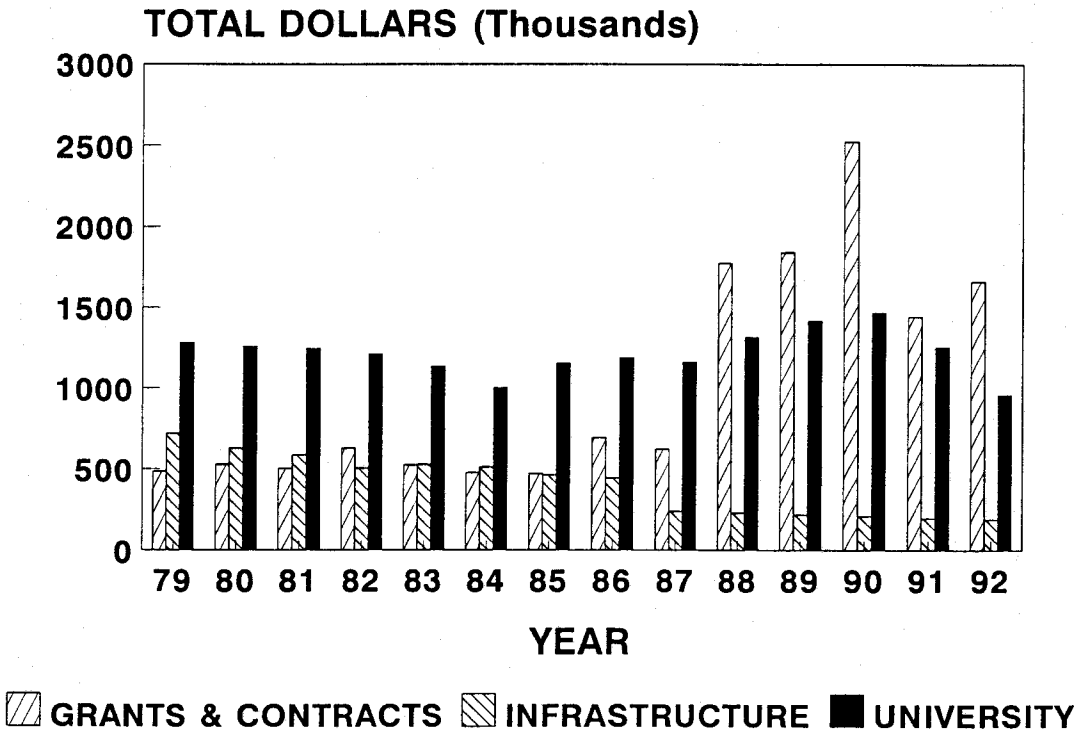

Fig. 2. Total funding for ocean sciences at Memorial University from 1979 to 1992: grants and contracts, external infrastructure, and university contribution. Real Canadian dollars, base 1986 = 100

and contract funding. From this observation, shown graphically in Figure 2, I suggest this rule: To be successful, university-based marine research requires infrastructure funding of the same order as grant and contract funding, plus additional university funding about equal to all external funding.

In 1987, infrastructure funding at MSRL declined significantly as a result of the end of such support from DFO (Fig. 2). Increased funding from grants and contracts in 1988 resulted in the expanded staff when OSC was created, but none of the new projects brought infrastructure with them. Large-project funding had first appeared in 1988–89, but in 1990 there was major influx from a new programme, the National Centres of Excellence (NCE). No infrastructure support was realised from this funding, but university expenditure increased somewhat, in an effort to take up the slack. But the Memorial University has now begun to experience the realities of "financial restraint", and the level of university support is diminishing.

We cannot tell where the scenario suggested by Figure 2 will lead to. It does seem clear that the external infrastructure support of the years before 1987 will not return. The University is not able to replace this level of support, although it has tried. One result should be the need for user's fees to cover a wide range of services; this is what has had to be done at OSC.

In the meantime, the commitment of internal resources, – in particular facilities and space – for large programmes like NCE has become established, and relatively more of the OSC university budget has to go to support these large programmes. Space and technical support now in place for large programmes are not available for the smaller, more traditional university research programmes. Likewise, the new user's fees which large programmes may be able to afford cannot be met by small programmes. Thus, faced with declining support generally, but especially that for infrastructure, universities may ill afford to become involved in scientific mega-projects. The growth that looked good in Figure 1 reflects deeper changes in scientific funding and management that bear critical scrutiny and reflection as to the consequences, a matter which Wallace (1981) called attention to some years ago and which Wunsch (1993), in a slightly different context, has again done quite recently.

What influence does a level of funding have on the production of scientific papers? At another jubilee held somewhat over a decade ago, we presented a retrospective on 50 years of growth at the Woods Hole Oceanographic Institution (WHOI). We found clear ups and downs in the funding and in the facilities available, but no apparent relation between funding and paper production (Haedrich & Emery, 1980). Figure 3 shows the

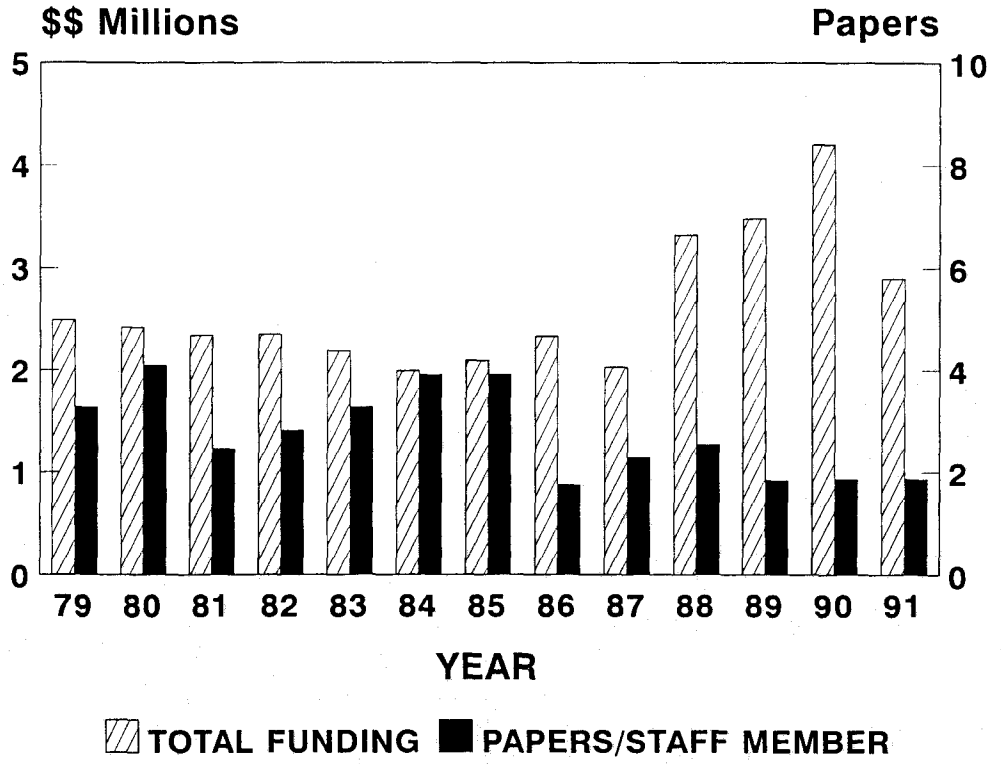

Fig. 3. Is productivity related to funding? Total funds (grant and contracts + infrastructure + university) for 1979–1991 (real Canadian dollars, base = 100, left axis) and number of scientific papers published per scientific staff member (right axis)

situation in Ocean Sciences at Memorial. There seems to be little relation here as well, with the value higher at first but eventually hovering around two papers per staff member per year. At WHOI, once an initial flurry of papers on new findings had appeared, the rate of publication settled down to a little more than one paper per staff member per year.

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LITERATURE CITED

Haedrich, R. L. & Emery, K. O., 1980. Growth of an oceanographic institution. In: Oceanography: the past. Ed. by M. Sears & D. Merriman. Springer, New York, 67–82.

Wallace, R. R., 1981. Organisational impediments to effective research on running waters. In: Perspectives in running water ecology. Ed. by M. A. Lock & D. D. Williams. Plenum Press, New York, 305–312.

Wunsch, C., 1993. Marine sciences in the coming decades. Science 259, 296–297.