

# The industrial research lab: a relic of the past?

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Basic research performed in industrial laboratories is declining — is the focus on profitability to the detriment of furthering scientific knowledge?

In the past, many large companies generously supported their own fundamental research laboratories, but now it would seem that many of these labs have decayed into near oblivion, and are becoming relics of the past. Some have closed entirely, the cutbacks at others have been drastic, and the research at those remaining seems to be focused mostly on short-term problems with concern over quarterly profitability.

It is popular to assume that basic research primarily benefits manufacturers, and that they therefore should be the prime sponsors of such work. But a host of discoveries have come from such labs with practical innovations that benefited all. In the area of materials science, a few past discoveries that come to my mind just from Bell Laboratories alone include flexible polyethylene that replaced the lead sheathing of telephone cables, artificial rubber that was strategic in winning the Second World War, ceramics to protect the cones of missiles re-entering the atmosphere, semiconductors and graphite carbon. But in today's climate of short-term profitability, the support of basic research in industrial labs is now seen to be an exorbitant luxury. This is a dangerous development, particularly in industries that are primarily service-oriented, such as telecommunication. Most revenues in telecommunication come from the provision of services, not the manufacturing of equipment. But the service providers themselves have a responsibility in ensuring their long-term future, and they should directly support basic research through the creation of their own labs. Thus far they have not been doing so. It will be interesting to see the fate of the former AT&T Shannon Laboratory now that the company has been acquired by SBC, one of the local telephone

companies divested from AT&T in 1984. Will SBC (which has decided to adopt the 'at&t' name) continue to support this research facility?

Even in the past, research was not conducted in complete isolation from reality. Thomas Alva Edison is credited with inventing the industrial research lab, as implemented at his West Orange, New Jersey lab with its extensive facilities and large staff of researchers from around the world. But Edison was quite pragmatic, and the research conducted there was focused on practical problems, the solutions to which were intended for commercial development. Although Edison and his researchers were very much aware of advances in pure science, their prime focus was on the practical and not to allow themselves to be motivated solely by a quest for knowledge for its own sake. This exemplifies one advantage of industrial research in that it supports the mission of the company. In the era of the former AT&T monopoly, the mission of the Bell System was to ensure the future of telecommunications in the United States, and IBM had a similar view with computing. Today, single organizations no longer have such broad missions.

Fundamental research is, of course, conducted at other institutions than industrial labs: universities, government labs and in labs sponsored by industry consortia. But the security of funding, sense of mission, freedom to pursue new directions, and proximity to the real world are quite different for each<sup>1</sup>. The prime mission of universities is education, and much research often forms the basis of doctoral education, usually with government support through a peer-review process that does not encourage really risky work. Government labs usually directly support the mission of the sponsoring agency — not society as a whole. All the sponsors involved in a consortium can become suspicious of each other

over proprietary interests, frequently with the end result that all lose any interest whatsoever in the research. This leaves the industrial lab to support the long-term needs of industry.

Studies on the health of research and development, such as that conducted each year by *IEEE Spectrum*, usually report on financial figures from industry that lump together research

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and development. Thus it is impossible without considerably more study to know the real situation in basic research at these companies, but from the yearly fluctuations that frequently track increases and decreases in sales, we are left mostly with a feeling that it is affected by a general malaise.

In my own work<sup>1</sup> I have examined the situation in telecommunication basic research at industrial labs in the US. Because of the break up of the Bell System that occurred in 1984, and a host of ensuing divestitures, research at Bell Labs became very fragmented, losing much of the critical mass of researchers in many disciplines that had existed there before the break-up. But in addition to a loss of researchers, much of the research had become focused on shorter-term practical business-related problems. But such decreases have been occurring across the world, and the financial markets, if anything, love the cost savings from the closures and cutbacks.

The challenges facing the future of industrial research are not new. Nearly five decades ago, William O. Baker, who led the research division at Bell Labs between 1955 and 1979 and who advised many presidents of the US, contemplated the fate of industrial research. He stated that "The annual cycle, the annual report, the annual budget dominate our culture. And because it takes so long to make the transition from brainpower to really revolutionary products, Americans, not only industrialists, just think there isn't a connection. They no longer know where things come from. In fact, this enslavement to the annual cycle has actually obliterated the reflective functions of American minds..."<sup>2</sup>.

Baker also observed "Research must be on a sufficient scale to assure that successes counterbalance failures and to permit work on concepts for which there is no immediately ascertainable application." But this certainly is no longer in vogue — the freewheeling research of the past just is not possible in today's industrial climate.

Are there any solutions? Clearly, one is to increase government support of research at universities and government labs. Any committee examining the problem will usually consist of many faculty members who would clearly support such a self-serving recommendation. But universities are too far removed from the realities of industry and markets (their prime mission is education) and peer-review seems to promote mediocrity rather than risky research for which the results might be uncertain. A research consortium is another solution, but multiple owners can have conflicting strategies. Government labs support the mission of a government agency and not necessarily the public at large. In the end, the industrial lab is uniquely suited to invent and discover new knowledge while being guided by a sense of mission with secure long-term funding. Government can support research at industrial labs, but the research will usually be focused on issues and problems of particular interest to the funding agency — not long-term researcher-directed research.

But the real challenge seems to be in clearly articulating the importance of basic research carried out in industry in an understandable and compelling manner. Baker attempted to do so and also to defend research freedom when he remarked in 1980 at an acceptance speech for the New Jersey Science and Technology Medal: "It seems that institutionalization buries ingenuity, if it is allowed to ... discoveries come from individuals, but ... institutions should bring them together without supplanting or submerging them ... discoveries and developments can serve all, through the marketplace. They can lighten our lives while lifting our souls, through worldwide electrical communion, through easing of illness, through shifting the burdens from muscles to machines, through adding to food and shelter, to clothing and comfort."

### REFERENCES

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2. Baker, W. O. (interview by M. Wallace) in *Second Rate Brains* (ed. Lansner, K.) 75–77 (Doubleday News, New York, 1958).
3. Testimony of William O. Baker, FCC Docket No. 16258, Bell Exhibit 21, (dated May 31, 1966).