

Innovation and Investment

By Bart Stuck and Michael Weingarten

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In “Death of Innovation (Revisited)” and “Innovation and Profitability” (downloadable at www.signallake.com/publications), we concluded from an examination of 1300 high tech IPOs that the level of technological innovation is relatively low and has declined significantly since 1996, despite a increasing willingness by the market to value high-innovation companies at a premium. The issue is why.

In this article, we examine another of the possible drivers of reduced innovation: reduced R&D spending. As we already noted in earlier pieces, VC investment increased by a factor of 10 in the post-1996 period (Table 1), so that’s not the problem. However, we previously observed that most of the original sources of innovation are large corporate and university laboratories rather than startups (with VC-backed companies commercializing innovations that originated at these facilities). If so, it could be the case that a drop in ‘upstream’ funding resulted in a decline in the level of innovation downstream. We test this theory below by examining recent R&D funding levels.

**Table 1
Annual US Venture Capital Funding**

Year	Number of Companies	Venture Financing
2002	3,134	\$30,438
2001	5,267	52,212
2000	8,859	131,984
1999	4,890	63,990
1998	2,860	24,822
1997	2,122	13,194
1996	1,797	10,457
1995	1,133	6,417
1994	746	2,990
1993	671	2,469
	Per Year	Per Year
97-02	4,522	52,773
92-96	1,087	5,583

Source: Venture Economics quoted in Morgan Stanley [Technology IPO Yearbook](#); Signal Lake Analysis

Corporate Funding

In our 1997 article "Death of Innovation," we looked at R&D spending for eight major telecom equipment providers in 1985 and 1995. As of 1995, R&D funding for these companies had increased by a factor of 2.8 times in the previous decade, from \$4.9B in 1985 to \$13.7B in 1995. So our concern about corporate R&D funding at that time was future-oriented rather historical.

Updating these for more recent years, we see that corporate R&D approximately doubled from 1995 to 2000/2001 (Table 2). Even with a 22% decline in 2002 with the telecom depression, R&D spending was still running 50% higher than in 2002.

This was particularly true for Lucent, whose R&D spending grew from \$2.6 billion in 1995 (pre-AT&T spinoff) to \$3.5 billion in 2001. It's only recently that spending has dropped below 1995 levels.

So net-net, it's hard to argue that a drop in R&D funding led to a decline in innovation in networking.

Ditto for R&D funding among selected leading computer, chip and software companies (Table 3), which increased 85% from 1995 to 2002.

University Research

The same holds true for university research. NSF data does not break out university R&D by area, but the overall numbers suggest that university R&D grew from \$15.1 billion in 1995 to \$22.9 billion in 2000; \$25.3 billion in 2001; and \$27.8 billion in 2002 (source: NSF).

Approximately 2/3 of university research funding comes from the US government, which does break out funding by discipline, and also by basic versus applied research. Looking at Federal funding trends (Table 4) results indicate that while US government spending has continued to rise over time, in parallel with overall growth in university R&D.

However, over 60% of funding is for biological sciences. Computer science, mathematics and electrical engineering at universities only received \$1.2B in federal funding; of this, only \$800M was in basic research. Put another way, Cisco spends 3.5 times the US government budget for computers and electronics.

Table 2
R&D Spending by Selected Telecom Companies
\$Billion

	1985	1995	2000	2001	2002	2003
Lucent	2.0	2.6	3.2	3.5	2.3	1.5
Agere	0.0	0.0	0.8	1.0	0.7	0.5
Avaya	0.0	0.0	0.5	0.6	0.5	0.4
Subtotal Lucent + Spinoffs	2.0	2.6	4.5	5.0	3.5	2.3
AT&T	0.3	1.5	0.3	0.3	0.3	
Subtotal Lucent + AT&T	2.3	4.1	4.8	5.3	3.7	
Bellcore	0.8	1.0	NA	NA	NA	
Subtotal: Bell System Spinoffs	3.1	5.1	4.8	5.3	3.7	
Ex Bellcore	2.3	4.1	4.8	5.3	3.7	
Ericsson	0.3	2.3	4.4	4.6	3.0	
Motorola	0.5	2.2	4.4	4.4	3.8	
Nortel	0.4	1.6	5.5	3.2	2.6	
Cisco	0	0.3	2.7	3.9	3.4	
Alcatel	0.6	2.2	2.7	2.6	2.3	
Subtotal Other Major Suppliers	1.8	8.6	19.7	18.7	15.1	
Total	4.9	13.7	24.5	24.0	18.8	
Ex Bellcore	4.1	12.7	24.5	24.0	18.8	

Source: Public Financial Statements

Table 3
R&D Spending by Selected Telecom Companies
\$ Million

	1994	1995	1996	2000	2001	2002	2003
IBM	4363	4170	4654	5151	5290	4750	
Intel	970	1111	1296	3897	3994	4034	4360
Microsoft	610	860	1432	3770	4379	4307	4659
HP	2000	2300	2700	2600	2670	3312	3652
Xerox	895	951	1044	1071	997	917	
Total	8838	9392	11126	16489	17330	17320	

Table 4
US Government Funding Support for University R&D
Total R&D Dollars

	1985	1995	2000	2001	2002
Total Funding Support	5,463,524	9,957,076	15,588,828	18,257,539	19,032,426
Life Sciences	3,239,373	5,642,443	9,357,175	11,294,274	11,805,757
Percent of total federal funding	59.3%	56.7%	60.0%	61.9%	62.0%
Math & Computer Sciences	251,816	535,117	792,873	885,340	948,213
Electrical Engineering	118,364	173,686	181,805	205,384	202,113
Total					
Computer/Electronics	370,180	708,803	974,678	1,090,724	1,150,326
Percent of total Federal Funding	6.8%	7.1%	6.3%	6.0%	6.0%

Source: NSF, Signal Lake analysis

Conclusion

From the above data, it's hard to argue that the drop in high tech innovation was due to a drop in R&D funding at large corporate and university centers. The opposite is true. So we are left with the quandary: with more money spent on high tech R&D in the late 90s/early 00s, why are we seeing less innovation?

Looking forward, the limited amount of Federal support for electronics and computing research, combined with significant reductions in corporate R&D in the last couple of years, raises a question as to whether this will result in substantial reductions in future high tech innovation.

So, if we want to see continuing innovation in electronic high tech, we need to see more emphasis from the VC industry in fostering genuine innovation rather than lots of low-innovation variations on a common theme. And some more government funding wouldn't hurt. After all, DARPA's original funding of the Internet has paid off big-time in major US economic growth.