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Secrets to shield or share? new dilemmas for military R&D policy in the digital age

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Abstract

The US Department of Defense (DOD) normally pursues a closed approach to technological development. It captures results from its own sponsored research and development (R&D), and the results are kept shielded by restrictions on related publications and exports. This R&D strategy is no longer viable. Now most military technology has commercial origins, the US no longer dominates all relevant technological fields, and sophisticated dual-use technology is accessible to adversaries in open global markets. DOD can address this dilemma by drawing on external R&D that tests a technology's general capabilities against a variety of potential uses and by placing more of its internal emphasis on technology integration. Historically, this approach to military R&D also yields more commercial spin-offs.

Keywords: Military R&D; Dual-use technology; Innovation; Export controls; Spin-offs

1. Introduction

Those who undertake to analyze the economic impact of the US military's research and development (R&D) investments typically choose to take sides. They either make a list of commercial spin-offs, deriving the economic benefits to the United States of the de facto industrial policy operated by the US Department of Defense (DOD), or they illustrate the baroque character of US weapons technology and decry the diversion of productive resources to such obviously unproductive ends (Gold, 1990; Reppy, 1999). In fact, both outcomes are evident in the historical record. Moreover, the analysis presented here indicates that these distinct outcomes are associated with two distinct approaches to organizing military research and development.

The Pentagon's dominant approach to organizing R&D reflects a grim trade-off that was often deemed necessary for protecting American security during the Cold War. The United States and its NATO allies relied on American technological superiority to trump the numerical superiority of the Warsaw Pact in men and material. To sustain and extend that superiority decade after decade, the Pentagon made massive investments in sponsored research. These investments were often combined with secrecy protocols and export controls designed to prevent any new technology from leaking to the Soviet Union.

The dawn of the digital information age has created a dramatically different environment. Most military equipment now derives from highly sophisticated commercial technology. The US no longer dominates technological fields underlying a broad range of

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Table 1
Characteristics and outcomes of US military R&D strategy of shared innovation

Technologies				
Variable features of military R&D	Solid-state transistors and integrated circuits	VLSI and CAD design tools	Photo-lithography equipment (Sematech)	Computer networking (Internet)
Targeted specific application or general capability	General capability	General capability	General capability	General capability
Led by military contractors, commercial suppliers, or universities	Commercial suppliers and universities	Universities	Commercial suppliers	Universities
Civil–military research trajectories converged or diverged	Converged	Converged	Converged	Converged
Interaction with R&D outsiders permitted or restricted	Permitted	Permitted	Permitted	Permitted
Outcome				
Achieved military's objectives	Yes	Yes	Yes	Yes
Impact on commercial prospects	Positive	Positive	Positive	Positive

potential dual-use applications (US Department of Defense, 1987, 1995; Gansler, 1989; Alic et al., 1992; Stowsky, 1992, 1999). And because digital information technology is so easily disseminated via portable media or over the Internet, the rate of technological diffusion is bound to accelerate. Thus, since the late-1970s, the Pentagon's policy of sponsoring classified research has not prevented superior, commercially derived versions of critical dual-use technologies from reaching the open global market, where they are equally accessible to allies and adversaries.[1]

My argument is that a feasible response to this new security dilemma can be found elsewhere in the Pentagon's own historical experience of organizing military R&D. I examined 10 major cases between 1949 and 1999 in which the US Department of Defense sought deliberately to leverage the commercial industrial base to develop a new military technology. I identify two distinct patterns of civil–military interaction, corresponding to two distinct approaches to organizing military research and development.

The first of these I call Shielded Innovation. R&D projects organized along these lines: (a) targeted specific product applications for defense; (b) placed traditional defense contractors in charge to guarantee the project's fealty to military needs; and (c) restricted the flow of information between defense-sponsored researchers and researchers and potential technology users on the outside. The other approach is what I call "Shared Innovation." Projects organized along these lines: (a) aimed at advancing a general technological capability; (b) allowed pure academic curiosity or commercial ambitions to drive the trajectory of technological development; and (c) invited ideas to flow back and forth between participants in the defense-sponsored project and other researchers and potential technology users on the outside. As I discuss in Section 2, these shared R&D projects often yielded dual-use technologies with performance attributes that converged with the needs of consumers in mainstream commercial markets, eventually producing successful commercial spin-offs (see Table 1).

Until the late-1970s, as discussed in Section 3, military R&D projects organized according to the principles of shielded innovation reliably produced technologies that served the Pentagon's military objectives. But this approach often yielded specialized product applications that diverged from the needs of

[1] When scholars assess technology policy retrospectively, they typically define the term "dual use" to mean, as Cowan and Foray (1995, p. 851) describe it, all those technologies "developed and used both by the military and space sectors on the one hand and by the civilian sector on the other." Molas-Gallart (1997, p. 370) is correct to note, however, that the eventual use by either sector of a technology initially developed for use by the other may be unexpected, and that a technology can be defined as dual-use "when it has current or potential military and civilian applications (emphasis added)." This is the definition of dual use that policy makers should bear in mind when designing technology development strategies prospectively and so is the definition I adopt here. See Reppy (1999) for a history of the dual use concept.