Finishing Trends & Technologies

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The Invention or Innovation Industry ... Autonomous & Connected

In the last column, I discussed *The Innovator's Dilemma* by Harvard Business School Professor Clayton Christensen.[1] The basic innovator's dilemma is that the requirements for a company to be both innovative and to respond to customers are in conflict. There are numerous examples of loss of market dominance by innovative companies that:

1. Employed good management practices,
2. Listened to their customers, and
3. Invested in new technologies.

Prof. Christensen's seminal work defined the innovator's dilemma as the irresolvable conflict between staying focused on the current market and, at the same time, recognizing and exploiting new opportunities. Prof. Christensen suggested that companies could circumvent the innovator's dilemma by establishing autonomous yet connected entities, such as spinouts, divisions, cost-centers, strategic business units, etc.

As I see it, however, there is still a fundamental dilemma to the innovator's dilemma. How are these organizations "connected" yet "autonomous" from the parent company?

The central or corporate R&D lab, which accomplishes "autonomy," is too far removed from the needs of the operating plants or divisions. Furthermore, "taxation (of operating divisions) without representation" does not qualify as connected. Advanced manufacturing groups, co-located with production facilities, are too connected and are continually called upon to "fire-fight" manufacturing problems. This level of "connectedness" prohibits the advanced manufacturing group from addressing the longer-term innovation needs of the company. Finally, some corporate-funded spinouts reportedly address the dual requirements of connected and autonomous. But, if they are truly autonomous, they must be allowed to fail, and there must not be a guaranteed safety net for the employees to safely return to the parent company if the venture fails.

The Innovation Industry

I see a possible solution, however, to simultaneously establish autonomy and connectivity—the fundamental dilemma (problem) associated with the innovator's dilemma. A new industry is emerging consisting of small, inventive/innovative companies associated with the federal government's Small Business Innovation Research (SBIR) program, and more recently, the Small Business Technology Transfer (STTR) programs. These companies meet many of the criteria associated with Prof. Christensen's "solution" of autonomous yet connected organizations. Specifically, SBIR/STTR companies are: (1) small, ranging from one to no more than 500 employees, (2) innovative, by definition, (3) used to surviving on low profit margins, (4) allowed to fail, and (5) required to commercialize or innovate.

According to the General Accounting Office, to compete in a global economy, the U.S. will increasingly depend on innovation through research and development.[2] The SBIR program was created in 1982 to stimulate technological innovation by requiring federal agencies to allocate approximately 2.5 percent of their extramural research funding to small businesses.[3] The STTR program, separately funded from SBIR, was created in 1992 with the added requirement that small businesses and research institutions collaborate on research and development projects. The SBIR and STTR programs are designed to stimulate technological innovation by exploiting the entrepreneurial talent of small, high-technology businesses and the innovative ideas and science and engineering expertise of our universities and research institutions.

Virtually every government agency participates in SBIR, specifically Departments of Agriculture, Commerce, Defense, Energy, Education, Health and Human Services, Transportation and the Environmental Protection Agency, NASA and the National Science Foundation. Current participants in STTR include Departments of Defense, Energy and Health and Human Services, and NASA and the National Science Foundation. These agencies periodically—typically once a year—publish research solicitations designed to provide the government with technical and scientific solutions to challenging problems. The government demand for cost-effectiveness and/or commercial off-the-shelf (COTS) acquisition simultaneously addresses the needs of commercial markets.

In summary, the main objectives of the SBIR/STTR program are to:

1. Stimulate technological innovation by small businesses,
2. Increase small business participation in federal research and development activities,
3. Commercialize the SBIR/STTR developed technology.

Some of the solicitations may address very specific needs of the

federal agency, while others may be very generic. In either event, many topics address research needs relevant to the metal finishing industry. Examples include advanced plating or metal finishing coatings or processes, pollution prevention technologies, environmentally benign plating, or metal finishing coatings or processes.

A Three-Phase Innovation Process

The SBIR/STTR programs consist of three phases:

Phase I—Approximately $100K of funding for six months to a year to establish technical and economic feasibility of an innovative process or product.
Phase II—Approximately $500 to $750K of funding for 24 months to further develop the technology as a pre-commercial prototype.
Phase III—Generally, private sector funding is anticipated to commercialize the technology.

The program is highly competitive, and only those proposals with innovative approaches to high-risk/high-pay-off technologies are funded. For example, only about 8 to 12 percent of Phase I proposals are awarded, and only about 30 percent of Phase II proposals are funded. In most cases, SBIR/STTR addresses high-risk early technologies which even early stage venture capital firms would not support. Consequently, SBIR/STTR may be thought of as "non-equity venture capital" funding and, in many cases, SBIR/STTR funding is used to subsequently attract venture capital funding.

A Billion Dollar Industry

In the sixteen years between 1982 and 1998, approximately 45,000 SBIR awards have been made to 5,000 companies for a total of $8.4 billion dollars (1998 dollars).[4] From the first-year funding of $45 million, the funding for the last three fiscal years has reached $1 billion annually![5]

Connected

Important evaluation criteria for SBIR/STTR programs include scientific and technical merit, the credentials of the principle investigator, and company facilities and commercial potential. The reviewers consist of technical experts and are generally looking for answers to the following two questions:

1. Is the technology or technical approach innovative?
2. Is it likely that the proposing firm will commercialize the technology?

Successfully funded proposals will make the case for market need in addition to the innovativeness of the technology. The commercialization paths for SBIR/STTR projects include:

1. Acquisition of the technology via license or purchase of the intellectual assets,
2. Acquisition of the SBIR/STTR company itself,
3. Subsequent venture funding and initial public offering,
4. Graduation of the small company to big business status.

In my view, by far the most common scenario is the transfer of the SBIR/STTR technology to on-going companies via license or asset purchase. These large companies possess the capital and market channels to exploit the innovation.

By nearly all accounts, the SBIR/STTR program is considered a very successful government program with strong bipartisan support. Approximately 35 percent of the awards have resulted in commercial sales and 45 percent have received additional development funding from non-SBIR/STTR sources. SBIR/STTR companies are, by definition, connected.

Autonomous

Government accounting requirements associated with SBIR/STTR awards are stringent and specify that direct project costs and company overhead costs must be justified. Furthermore, the allowable fee (before taxes) on SBIR/STTR projects is typically in the 7–10 percent range. Consequently, there is no financial incentive to participate in such a low profit margin market. Rather, SBIR/STTR companies are in the innovation industry in order to exploit the commercial benefits of their technology. In fact, as if the financial incentive were not enough to motivate commercialization, companies receiving multiple awards are being asked to show evidence of commercialization as an evaluation criteria for future awards.

Finally, approximately 750 new companies enter the SBIR/STTR market yearly. Consequently, SBIR/STTR companies are continually failing in this highly competitive industry. These companies are truly autonomous with no fail-safe position for their principals or employees.

In summary, SBIR/STTR companies are part of a new billion-dollar innovation industry. These companies, by their very nature, fulfill the need for autonomy and connectedness and consequently address the innovator's dilemma. They mitigate the high risk associated with emerging innovations and are used to surviving on low profits and facing the reality of failure. With their drive to commercialize, they continually look to market opportunities for their technology. These companies can, in effect, become the "virtual R&D labs" for their larger strategic partners.

Because it is extremely difficult to quantify commercialization cause and effect resulting from SBIR/STTR companies, I'll devote the next two columns to commercialization case studies related to the metal finishing industry. These case studies will illustrate the challenges encountered by the invention factories of the innovation industry in aligning technology, intellectual property, and business strategies. They will also provide guidance to metal finishing companies in identifying and working with these invention factories. *P&SF*

References

1. Clayton M. Christensen, *The Innovator's Dilemma*, Harper Business Publishers (1997).
2. "Federal Research: Observations on the Small Business Innovation Research Program," http://sun00781.dn.net/man/gao/rced-98-170.htm, Oct. 23, 2000.
3. "An Explanation of SBIR," http://www.win-sbir.com/overview.html, Nov. 14, 2000.
4. Susan D. Kladiza, Testimony Before the Subcommittee on Technology, June 17 1999, U.S. General Accounting Office, Washington, DC, GAO/T-RCED-99-198; http://www.gao.gov.
5. Honorable James A. Barcia, Opening Statement to the Subcommittee on Technology, June 17, 1999; http://www.house.gov/science_democrats/member/jb990617.htm.