Finishing Trends & Technologies

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Pasteur's Quadrant & the Acquisition of Innovative Technology

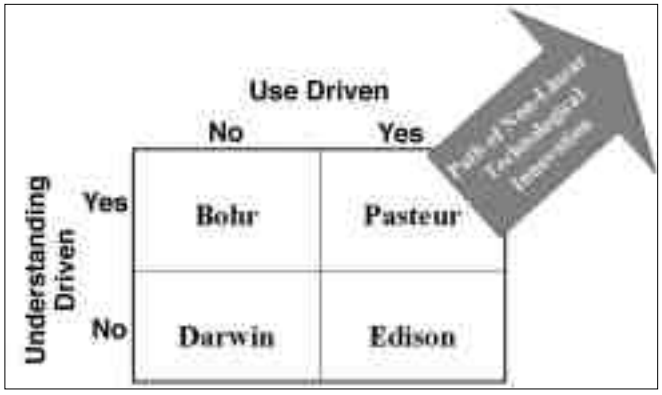
During the past two columns, I presented case studies regarding the development of metal finishing-related technologies by companies participating in the "billion dollar innovation industry."[1] These case studies included a description of R&D Company, Inc. (R&DInc), a company participating in the federal government's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. The innovative technologies described were directed toward fragmented/horizontal[2] and structured/vertical[3] segments of the metal finishing industry. As a follow-up to these case studies, this column addresses:

1. The rationale for acquiring innovative technology.
2. Criteria for selecting the appropriate innovative company.
3. What to expect during the technology acquisition process.

Rationale for Acquiring Innovative Technology

The R&D companies participating in the SBIR/STTR programs are part of a new billion-dollar innovation industry[4] participating in federally sponsored R&D. It is estimated that there are more than 10,000 technologists[5] resident with these companies, more than the research staff of all universities combined. Clearly a competency in invention and innovation is emerging within the SBIR/STTR companies.

Outsourcing is chosen by companies when it is perceived that the outsourced function can be more effectively/economically performed. For example, the accounting/tax function and, more recently, electronics manufacturing services (nearly a $100 billion industry). What about looking outside the organization to augment the invention/innovation needs of a company? A study by Coopers and Lybrand suggested that a significant fraction of high-growth firms had outsourced their R&D functions by entering into R&D contracts with other organizations.[5]



The old model for R&D is based on the linear development paradigm of World War II's Manhattan Project. That is, the technology development process proceeds linearly from "fundamental science" to "applied research" to "products," *e.g.*, the development of the atomic bomb. However, a new dynamic paradigm views technological innovation as a parallel process with emphasis segmented by understanding and use.[6] The accompanying figure segments R&D into four quadrants, which are emphasized in terms of usefulness and understanding.

Quadrant I, Darwin's observations of species of the Galapagos islands were not motivated, initially at least, by a quest for fundamental understanding or with a particular use. Quadrant II, Bohr's research into the structure of the atom was directed toward understanding, without any consideration of its potential use. Quadrant III, Edison's search for the appropriate material for a lighting filament was motivated solely by practical need, without fundamental direction or desire for understanding. Quadrant IV, Pasteur was simultaneously motivated to create the field of microbiology while developing a practical process for the milk and wine industry.

An analogous segmentation is:

Quadrant I—observations and cataloging of weather data by amateur scientists for future scientific and technological use
Quadrant II—research institutions and universities focused on basic research
Quadrant III—companies attempting to develop a new technology outside their technical competency
Quadrant IV—companies participating in the billion-dollar STTR/SBIR innovation industry

While it does not make sense for a company to acquire technology from those in Quadrants I and II where the use is not emphasized, many companies fall into Quadrant III, and attempt to adapt the novel technology for their

needs via an "Edisonian" approach. They remind me of the companies who, after a cursory exploration, proclaim, "I tried pulse plating and it didn't work."[7] In contrast, the STTR/SBIR companies (Quadrant IV) are wired to the latest university research findings (and therefore understanding) by necessity, as their proposals are typically reviewed by academics. In addition, they are directed toward commercial use, except those working on narrowly defined DoD and NASA projects. It is these Pasteur's Quadrant companies, working on the leading edge of technological innovation, that are the prime targets for technology acquisition and/or R&D partnering. Alas, how does one identify the appropriate STTR/SBIR companies, *i.e.*, Pasteur's Quadrant companies?

Criteria for Selection

Probably the most important selection criteria for technology acquisition or "R&D partnering" would be stability. Because most companies fail within five years of start-up, longevity is an important indicator of stability. In addition, building ownership is another indicator of stability. Including manufacturing engineers as well as research scientists is a strong indicator that the practical issues associated with the innovative technology have been given a high priority. Finally, the use of recognized professional services firms and the existence of a formal banking relationship for credit needs is a strong indicator of stability. Positive cash flow and absence of long-term debt are indicators of sound business practices. Outside investment, even informal, is a good indicator of confidence in the organization.

A number of SBIR/STTR "mills" have become exceptionally proficient at writing and winning contracts but have not truly pursued commercialization and are not appropriate for technology acquisition or "R&D partnering." Some of these companies fulfill government mission requirements, particularly DoD and NASA, with high-quality studies and development of models.

In addition, a number of SBIR/STTR companies only feign to commercialize their technology, but in reality, live and die with proposal funding. Other SBIR/STTR companies only participate in the innovation industry temporarily as they secure venture capital funding and become established businesses serving other industries.

In assessing credibility, the key question has changed from "How much land do you own?" for the agricultural based economy, to "How much plant and capital equipment do you own?" for the industrial age to "How many intellectual assets do you own?" for the knowledge-based economy. Attention to intellectual property issues, while not relevant to the technology itself, is critical in establishing the competitive advantage associated with the innovative technology. Because the intellectual assets associated with the innovative technology are of considerable importance to the technology acquiring company,[8] the treatment of these assets is of considerable importance.

Technology Acquisition

The entity acquiring the technology must realize that it is not buying off-the-shelf technology. Rather, it is buying innovative technology whose technical and economic feasibility have been demonstrated. That is, the high-risk portion of the technological innovation is complete. Consequently, there are no technical barriers or "show-stoppers." Even so, there is a hand-off phase where the technology is scaled up and readied for insertion to the acquiring company. This hand-off phase is not like a quarterback instantaneously handing the ball to the fullback; rather, it is like the baton being passed during a relay race. The team members must run in stride for several paces and carefully nurture the technology as it is transitioned from innovator and inserted into a commercially viable process or product. *P&SF*

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