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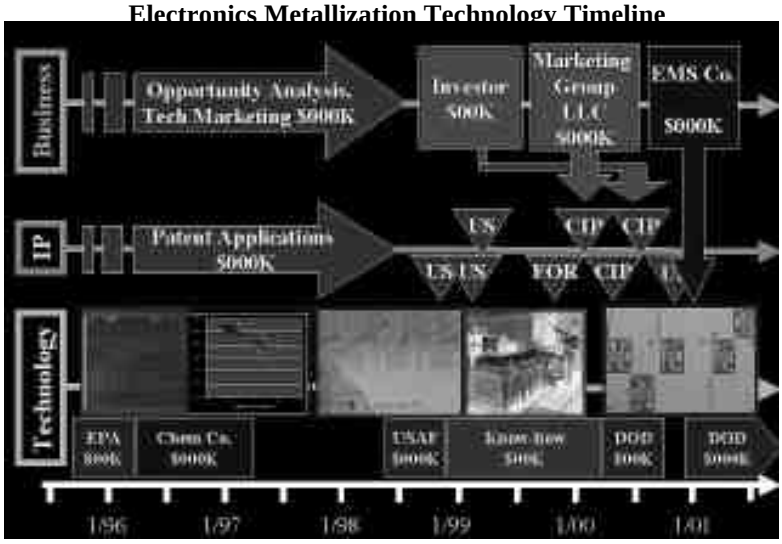
Acquisition of Electronics Metallization Technology

In the last column, I presented a case study of licensing edge and surface finishing technology from an SBIR company to the metal finishing industry. This column will present a case study of acquiring an innovative process technology for the electronics sector of the metal finishing industry. These case studies are meant to be illustrative of the opportunities for the metal finishing industry to acquire innovative technology from small, innovative, "invention factories."

Recall the previous discussion of the "innovator's dilemma," that is, the difficulty of companies to simultaneously serve their current clients' product requirements, and to recognize and exploit innovative opportunities. I have suggested that a new industry consisting of small inventive/innovative companies associated with the federal government's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs circumvent the problems associated with Professor Christenson's innovator's dilemma.

The R&D companies participating in the SBIR/STTR programs are part of a new billion-dollar innovation industry and by their very nature fulfill the requirements of autonomy and connectedness to circumvent the innovator's dilemma. They mitigate the high risk associated with emerging innovations, are accustomed to surviving on low profits and are continually faced with the possibility of failure. With their drive to commercialize they continually look to established companies in need of their technology, and in effect. can become the early stage "invention factories" for their larger strategic partners.

Electronics Metallization Technology Timeline



This second illustrative case study compliments the previous one and will provide guidance, *emphasized in italics*, to metal finishing companies in identifying and working with the R&D companies of the billion-dollar innovation industry.

R&D Company Inc.

R&D Company Inc. (R&DInc) was founded in 1991 as a "C" corporation. Rather than reiterate the full background associated with R&DInc, the reader is referred to the previous column.[3] Below, the italicized guidance is reproduced.

From a metal finisher's perspective, since most companies fail within five years of start-up, longevity is an important indicator of stability.

The ownership of its own building 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.

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.

Since the intellectual assets associated with the innovative technology are of considerable importance to the metal finisher, the use of professional intellectual property firms for their development is of considerable importance.

Outside investment, albeit informal, is a good indicator of confidence in the organization.

Several attributes distinguish R&DInc as a potential source of needed innovative technology to the metal finishing industry.

Critical to R&DInc's success in commercializing its innovative technology is the alignment of technical, intellectual property and business issues. For this case study, the chart provides a timeline as reference.

Technical

The technology development in this area began in 1995 with a Phase I SBIR contract from the EPA addressing a novel approach to environmentally-friendly plating. A plating chemical supplier was very interested in the technology and was included in the Phase II SBIR proposal to the EPA as the commercialization partner. In spite of this strong commercialization alliance, the Phase II SBIR was not funded.

Subsequently, the chemical supplier contracted with R&DInc for engineering services, as well as looking at a novel approach to augment their traditional approach to plating process control. During this 12-month effort, R&DInc generated data that suggested the traditional approach to plating process control could be replaced by the novel approach. Since this novel approach did not coincide with the chemical supplier's current business model, the supplier terminated the relationship.

In spite of securing a commercialization partner for its Phase I SBIR technology, R&DInc did not receive a Phase II award. Companies like R&DInc must quickly learn that the innovation market is difficult to predict. R&DInc experienced a setback regarding its' technology due to non-technical performance reasons.

A gap of approximately 18 months in the technology development timeline followed. During this time, R&DInc conceptually re-defined its initial environmentally-focused process technology, to address performance and cost advantages for semiconductor manufacturing. During this time, R&DInc submitted several proposals to various Federal agencies. After two proposals were rejected, the US Air Force funded a Phase I project. The performance and cost advantages of the novel process were demonstrated during the Phase I, however, follow-on funding did not occur. The process was perceived as too radical for the semiconductor industry to embrace and the USAF project officer did not believe commercialization would occur.

Since SBIR agencies employ different review panels, a proposal unfavorably reviewed by one agency may be favorably reviewed by another. The lack of follow-on funding provided R&DInc another valuable lesson of innovative technology being blocked for non-technical reasons.

In spite of the above rebuke, R&DInc felt the technology had merit. Another market within the electronics sector was identified, and further technology development was supported by substantial corporate investment. With this investment, R&DInc was able to construct the facilities required to develop the technology further.

Under "normal" return on investment financial analysis, the substantial monies expended by R&DInc could not have been justified. However, the "gut" feel of R&DInc owners/investors was sufficient to bridge the gap in funding.

Phase I funding was secured from the DoD. A key decision driver was the investment in facilities provided by R&DInc prior to submitting the proposal. During the Phase I program, the improved performance benefits of the novel process were demonstrated. The interest of a large manufacturer was secured, and this large manufacturer agreed to co-fund the further development of the technology in the form of testing, analysis, and engineering expertise. The Phase II proposal was favorably reviewed, and funding begins in early 2001.

In this case, the commercialization path was appreciated by the DoD SBIR project officer and favorably influenced the Phase II proposal award. Since the main driver of interest in the technology by the DoD is to have a vibrant commercial market to supply "commercial off-the-shelf" (COTS) technology for the DoD, the DoD may often be the source of funding for technologies with substantial commercial potential.

In summary, the technology development timeline is quite convoluted with a number of difficult-to-manage stops and turns. However, R&DInc's ability to fund gaps in grant funding and attract private investment is a positive indication of "staying power," commitment, and potential value of the technology.

Intellectual Property

The first US patent was filed in late 1998, near the end of the Phase I USAF SBIR. All patent matters were managed through the intellectual property group of a law firm with a Washington, DC office. This location facilitated ready access to the US Patent & Trademark Office. Prior art was searched and analyzed by professional intellectual property specialists. A patent attorney who also had a PhD in physical chemistry prepared all patent applications. Additional US and foreign patent applications were submitted while R&DInc invested in know-how development.

In order to pay for the rising costs associated with patent activities, the patents pending were sold to Marketing LLC in 2000. Marketing LLC, as noted previously[3], is closely aligned with R&DInc and is able to attract much-needed "friendly" informal investment to remove the legal cost burden from R&DInc's cost structure. Since R&DInc and Marketing LLC are separate legal entities, R&DInc's ability to conduct high-quality technology development is not compromised. In contrast, direct investment into R&DInc could jeopardize its ability to effectively function in the innovation industry.

The aggressive intellectual property activities, while not relevant to the technology itself, are critical in establishing the competitive advantage associated with the innovative technology. Furthermore, the aligned Marketing LLC with its associated tax advantages for the investors is strongly indicative of business savvy and technology potential.

Business

R&DInc hired a business development manager with a marketing background in 1995 to augment its technical staff and lead its technical marketing efforts, including managing technical paper presentations. Initially, non-proprietary aspects were

presented. Later, after patent applications were filed, more complete disclosure in technical presentations was pursued. In addition to technical papers, R&DInc exhibited at trade-shows affiliated with the technical conference. The trade-show exhibit was not designed to generate immediate sales, but rather to serve as a sort of traveling poster session to augment the communication of its technology. With time, R&DInc formed a business arrangement to vend equipment associated with its metallization process technology and periodically advertised in trade journals.

R&DInc also participated in numerous industry consortia and served on technical society boards and committees to enhance its' understanding of industry needs. In contrast to mass-mailings to companies with a potential interest/need of its technology, R&DInc's strategy was to be sought out by early adapters within the electronics manufacturing industry.

During the several years of technical marketing activities prior to developing fruitful industry contacts, R&DInc established credibility through its consistent message and staying power.

Innovative Technology Acquisition

By following the industry development closely, R&DInc observed the industry structure to change from a somewhat diffuse horizontal structure to a highly structured vertical structure. Based on scenario analysis, potential entry points to the industry are 1) original equipment "manufacturers" (OEM), 2) manufacturing services companies, *i.e.* the virtual manufacturers of the OEMs, or 3) via equipment or chemical vendor supply channels. R&DInc pursued collaboration with all three of these market entrée points.

The ideal market channel for R&DInc would be through an established chemical or equipment vendor supply channel. However, the metallization process technology is contrary to the chemical vendor's business model. While the new process technology represents a threat to the traditional business practice of the chemical supplier, it represents an opportunity to the equipment supplier to vertically expand and capture more of the supply chain. Consequently, a more likely market channel entrée may be established by collaboration with the equipment vendor.

The OEMs, while desiring to have their manufacturing services companies use the most cost-effective process technology, have declined to drive the process technology since it is not yet validated at a manufacturing plant. However, once the technology is validated, the OEMs will require that the chemical or equipment vendors provide the technology to the manufacturing services industry. Note, the OEMs are on record that they will not "sole-source" their manufacturing needs. Rather, they will maintain at least four viable manufacturing services companies.

As noted in the technology development section, the manufacturing services company participated in co-funding the Phase II SBIR and provides critical manufacturing and testing know-how. Without such know-how, R&DInc would not have a chance of validating the technology and demonstrating its readiness for commercialization. Consequently, for technology validation and securing the Phase II SBIR, R&DInc is closely aligned with the manufacturing services company. The successful validation at the manufacturing services company will generate the required interest from the OEMs and chemical and equipment suppliers with whom R&DInc intends to align for full market access. A major challenge for R&DInc will be the desire of the manufacturing services company to encumber the technology by an exclusive arrangement or by purchase of the patent assets.

R&DInc's commercialization plan for its process technology is formulated via scenario analysis, with options and pathways identified. This is in contrast to a business plan where the steps are identified and executed in sequence.

In next month's column, I'll compare and contrast these two case studies with particular emphasis on the role of industry structure in formulating strategy. *P&SF*