Finding New Sources of Technology

Many potentially valuable sources are being ignored by industry; more technologies needed

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New-product concepts, particularly those based upon advanced technologies, are in short supply.

Industry's appetite for new technologies obviously exceeds the current output of traditional technology sources.

We can't do much about the demand side of the equation, but it might be worthwhile to examine the system that supplies our technology.

Is the innovation process operating at maximum capacity or are there opportunities to increase technology outputs?

Those of us involved in licensing and technology transfer by reason of our knowledge and understanding of the innovation system can play an important role in defining ways to increase the output of the innovation system.

I would first focus on the generators of technology: universities, institutions, corporations, governments and individuals. Could it be that substantial portions of their valuable output doesn't enter the commercialization stream for reasons that have no relation to the value of the technology?

These technology sources, particularly research institutions and universities, are important generators of new concepts. Unfortunately, only a small fraction of these concepts are ever commercialized because most are in undeveloped form and as such entail substantial technical uncertainties.

Risk-adverse corporations are usually unwilling to assume the uncertainties of development in addition to the already high risks of commercialization. Most technology generators, particularly universities and not-for-profit institutions do not have the resources to fund further development. Except in cases of direct corporate funding, many excellent technologies from universities and institutions are being overlooked. Is there any way in which the risk and management of technology development can be shifted to others?

Fortunately, because of actions taken by the federal government opportunities exist to shift funding and development risks to outside investors. This option is based upon the research and development limited partnership (RDLP), pre-venture capital funds, and technology pools.

The government has taken additional steps in its research funding and patent policies that greatly aid in the development and ultimate commercialization of government-sponsored research. Now all that remains is to establish implementing systems and strategies that balance the interests of technology suppliers, their scientists, the needs of the commercial sector and risk assuming investors.

A key element of any such system would provide for adding value to undeveloped concepts and the potential for high returns on successful developments. The system must be compatible with today's, highly structured innovation system because new products no longer just happen. The time has long passed when the intelligent, persistent tinkerer such as the Wrights, Ford, and Edison can make inventions of ultimate economic significance.

THE INNOVATION PROCESS

Today's innovation process is comprised of three distinct but closely interrelated elements:

—Fundamental or Basic Research—adding to the store of basic scientific knowledge.

—Development—eliminating technical risks.

—Commercialization—scale up, production and distribution.

Different people see innovation in different ways. Last summer, at a conference sponsored by the Belgian government, innovation was characterized as a process in which the Europeans invent, the Americans develop and the Japanese commercialize.

COMMERCIALIZATION

Commercialization is the specialized process of getting completely developed new products into the hands of the ultimate consumer. Profit-oriented organizations do it well, institutions and scientists usually don't. Funding of commercialization is motivated solely by the potential for returns.

Even with completely developed technologies, commercialization is a high-risk process. When based on undeveloped or partially-developed concepts, commercialization becomes virtually impossible. With the risks of commercialization, it is not surprising that industry is reluctant to assume the additional burden of technological uncertainties.

Asking a company to consider a mere concept is like asking Swift to consider a newborn calf. However, when provided with developed technologies, industry has shown its willingness to assume the risks of commercialization.

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FUNDAMENTAL OR BASIC RESEARCH

At the opposite end of the innovation process is fundamental or basic research that can be characterized as technology for technology's sake, adding to the store of scientific knowledge.

Basic research is typically carried out in universities, government laboratories and research institutions by individuals who are perceived to be "knowledge-oriented" as opposed to profit-motivated. Likewise, the funding of basic research is usually by sources primarily motivated by the expectation of scientific breakthroughs rather than monetary returns. Classic examples are government grants, foundations and university endowments although recently some large corporations have been involved. The Monsanto-Washington University and the Exxon-MIT programs come to mind.

Unfortunately, scientific knowledge, as such, has little intrinsic commercial value. If you are a doubter, I suggest you try to commercialize Newton's law of gravity. Before development, and ultimately commercialization, can take place, an inventive concept must intervene.

THE INVENTIVE CONCEPT

All inventions are not created equal. They fall into two categories — those that timely meet a market need and those that do not. To have commercial potential the invention must be able to penetrate a market window. This has little to do with the merits of the invention.

To illustrate, the medical scientists at a certain major university have developed a hybridoma kit for early diagnosis of breast cancer. It is better and more effective than any existing technology. Unfortunately, the development occurred three years after a less effective but entirely satisfactory kit was introduced. It would now be virtually impossible to dislodge the earlier product, which has been accepted by clinicians and doctors.

To be commercially successful and warrant development, an inventive concept must fall squarely in the current "need" category. Industry plays the game by directing scientists to invent only those concepts that answer a clearly identified commercial need. These "need-derived" concepts stand a good chance of finding a home in the commercial world.

Inventions originating from outside the corporate environment are seldom "need-derived." They usually result from an inventor's technical curiosity, involvement with some other project or a personal perception of a commercial need. While such inventive concepts may be highly creative and technically sound, like throwing darts blindfolded, they are unlikely to be accepted by the industry unless or until a timely commercial need is established.

The classic example of a "non-need-derived," technically-sound invention is the cotton picking machine, an invention of the 1870s based upon an inventor's perception of a market need. It wasn't until the 1940s that the market conditions justified its first commercial use.

Lest you be totally discouraged about the potential for inventor-derived concepts, rest assured many meet substantial, current, market needs. I particularly invite your attention to those originating in problem solving universities and research institutions, or those that are by-products of corporate research. Individuals also make valuable contributions, note Carlson and Xerox.

There are no data available to quantify the proportion of corporate by-product and independent invention that have commercial potential. We believe, however, it would likely be comparable to our company's experience with SRI International — of the first inventory of some 190 inventions received from that institution some 13 were deemed to meet significant market needs.

We believe that an 8% yield is reasonably representative of problem-solving institutions. This would indicate that there is a vast untapped source of technologies in various stages of development available for further development and commercialization.

DEVELOP OR SELL

The owner of the "green" concept must make a develop or sell decision much in the same manner as the owner of any other undeveloped commodity be it a newborn calf, a stand of timber or whatever. He can do nothing, he can sell as-is-where-is or he can add further value to reduce the commercial risk. In the case of inventive concepts this usually means further development.

The decision is influenced by the availability of funds and management as well as the commercial priorities of the technology owner. All too often the decision is to do nothing with the result that a potentially desirable technology resource is wasted.

The second option, that of selling "as-is-where-is," is not much better unless the receiving entity happens to be ready, willing and able to assume the risks inherent in the development process. The previously mentioned reluctance of corporations to consider undeveloped ideas often surfaces with such comments as "not invented here," "crowding out," and "not enough data."

Unless the technology owner is extremely lucky and has a concept that just happens to meet a specific corporate need the chances of finding a willing buyer are slim indeed.

This leaves the last option: developing the concept, adding value, assuming risk *before* the transfer takes place.

Just how far development should be taken depends upon economic, technical and industry factors. Each technology is a separate and distinct case. For example, with pharmaceuticals, it is usually more efficient to carry development partially into Phase 2 efficacy testing. Thereafter most drug companies are better equipped to more effectively carry out the remaining clinical and other tests necessary for FDA approval.

With electronic circuits, development usually continues until the technology is thoroughly tested and proven. In some instances, development continues until an integrated circuit is designed and tested.

INDEPENDENT DEVELOPMENT ENTITY

The process of identifying diverse technologies that serve market needs, funding, planning and managing development and the transfer to commercial entities is a specialized activity involving a variety of skills and resources. There are many approaches including those sponsored by governments, development agencies, investment bankers, corporations, universities and institutions.

It is clearly a concept whose time has come born out of the necessity for more technologies in a form acceptable

for commercialization.

GOVERNMENT POLICIES

While approaches may vary, advantage should be taken of the several government policies and laws that encourage technology development. The first is the research and development limited partnership (RDLP) based upon three cornerstones:

—Section 174 of the IRC, which permits taxpayers to currently deduct qualifying research expenditures.

—The decision in *Snow v. Commissioner,* 416 U.S. 500 (1974), which allows a limited partner to offset other income with Section 174 expenditures even for products not yet offered for sale.

—Section 1235 of the IRC, which provides capital gains treatment for the sale of all rights to a patent under certain circumstances.

The second is the surprisingly enlightened recent trend in governmental patent policies. Under current regulations, not-for-profit institutions may receive patent rights and the right to commercialize technologies resulting from governmental sponsorship. The government of course retains a perpetual, royalty-free right to the technologies reduced to practice under federal funding.

The third aspect has to do with funding of technical development. The federal government expends large sums to fund not only basic research but the development of technologies for its various needs. In 1981, federal funding of research and development at the 100 most active universities amounted to over $3.8 billion. Many of the technologies developed in these programs have a commercial potential in addition to government uses and offer a potential source of new commercial products.

THE COMMTECH APPROACH

Illustrative of an independent approach to technology development is our system. CommTech's strategy is based upon our recognition of the need for new products, the availability of inventive concepts from universities, institutions and other sources, the requirement that these concepts be substantially developed before industry will accept them and the availability of government programs to encourage technology development.

Since new product development is an ongoing function rather than an ad hoc activity, we formed CommTech International (CI) to provide a permanent capital base for technology selection, development and transfer to the commercial sector. CI is a technology company structured in the form of a limited partnership. We own our raw material, the technologies that we develop. CI has three basic classes of partners. SRI International and the investors are limited partners, and CommTech International Management Corporation serves as the managing general partner.

SRI RELATIONSHIP

SRI is a key factor in the CommTech program. It has contracted to make available, on a long term basis, all of its proprietary technology concepts. Title to SRI technologies accepted by CI passes to the partnership giving CommTech and its owners a direct, vested interest.

SRI has adopted an enlightened income-sharing program with its inventors. Under this program, a substantial proportion of SRI's income from CI is made available to the inventor and his laboratory group. We feel that sharing with scientists and inventors is an important means of encouraging technology output.

Nothing in the CI-SRI relationship in any way affects the normal SRI contract relationship with its corporate and other clients.

The most significant source of proprietary technologies, in the case of SRI, arises from government-funded projects. The other sources are internally-funded projects and technologies that may be released from time to time by corporate clients. Our program provides SRI with an opportunity to receive contract income and also a share in the profits from technologies that are successfully commercialized.

We are not limited to SRI as a source of new technology concepts. We seek technologies from other sources such as institutions, universities, corporate research divisions, which have concepts outside their commercial interests, and individuals. Thus, we provide an alternative means to develop concepts.

THE OPERATION OF COMMTECH INTERNATIONAL

While our primary focus is on the development segment of the innovation process, CI's activities involve six primary areas: technology sourcing, evaluation, identifying market needs, development, transfer to the commercial sector, and financing. Perhaps the best way to illustrate our method of operation is to trace a representative technology through the system.

BLOOD PRESSURE MONITORING DEVICE

The first is an example of a technology received in partially developed form. The technology involved in ambulatory blood pressure device developed for the NASA space program. Technical feasibility having been established for space applications, it remained to develop a device that would meet size, cost and performance standards necessary to serve commercial market needs.

In addition, the device's unique and highly accurate blood pressure monitoring capability suggested the possibility for a new software concept to provide a breakthrough in the diagnosis of coronary malfunctions.

We confirmed that market potentials and returns justified the costs and the risks of the development necessary to meet commercial specifications established in conjunction with industry sources. Services of outside medical, market and technical consultants, as well as inputs from the medical instrument industry, were retained to supplement CommTech's internal resources.

Contract arrangements, in this case with SRI and a leading medical school, were made to firmly establish development goals and costs. After formally accepting the technology, we formed an RDLP that in turn was financed by a private offering made through our investment bankers. Upon successful completion of the development of the blood pressure concept we will transfer the technology by license to an existing company or establish a joint venture or new enterprise for commercialization.

Properly structured, the technology development sys-

tem should complement rather than compete with the technology generating and commercial sectors. It should serve these groups by providing alternatives to their own resources.

In the case of the corporate community, we provide a technology stream to supplement internal development programs and we offer an alternative means to develop and fund corporate technologies which may fall outside their areas of immediate interest.

To work with the larger corporate community, we have established an informal corporate contact program with a number of firms. We benefit by their comments as to the market specifications and the commercial potential of our technologies and they benefit by being aware of our new concepts at an early date.

SUMMARY

More technologies are needed to meet industry's needs for new products.

Many potentially valuable concepts are being generated by a variety of sources but are being ignored by industry because of development uncertainties.

Government policies and economic factors encourage the establishment of risk-assuming independent development programs as viable alternatives to internal-funded options.

Those involved in licensing and technology transfer are encouraged to consider these programs for their own needs.