

A New Thrust in Innovative Technology Commercialization

The Garn Advanced Manufacturing Business, Information & Technology (GAMBIT) Center

Background

In recent decades, the U.S. economy has been significantly weakened through the loss of traditional manufacturing jobs. This productivity loss has occurred at a time of great technological expansion. America understands and encourages innovation better than any other nation on earth. Congress has been steadily increasing basic and applied research funding. In FY04, over \$130 billion was awarded to research institutes, universities, and colleges, etc. After the Bayh-Dole Act in 1980, individual states began investing in maturing new technologies for local economic development purposes.

Today most states have established some kind of mechanism to advance new technologies towards commercial application. In almost every case, federally subsidized technologies need enhancement to be more readily transferable to industry. States investing in this process have hoped new start up companies or industries within the state would leverage these maturing technologies to benefit the growth of their local economies (several examples exist where this effort has been successful).

Since such technologies are often developed within a university, generally it is the technology transfer or intellectual properties office that is responsible for licensing the inventor's technology to industry. In general, these offices have limited marketing budgets. Their main interface is with corporations that seek out students for employment, or that contract with faculty members and professors to fund faculty or student projects and otherwise become involved with the university or college. These campus-based technology transfer efforts have had some success. However, a major weakness is that such advanced technologies are only known by and marketed to a very limited number of potential licensees.

Campus-developed technologies are generally licensed by companies to incorporate them into new or enhanced products. Most licensees are large corporations with 500 or more employees. Importantly, they represent only 1% of U.S. manufacturers. Most of the 350,000 medium to small manufacturers have little to no exposure to these new technologies. This missed opportunity is significant since such companies produce 52% of the manufacturing GDP, and employ 67% of the workforce (~12,000,000 employees) in the manufacturing sector. They also provide more than 85% of the sub-contract work for large manufacturers, and they represent 99% of the total number of manufacturers in the U.S. This industry sector's direct supply chain supports tens of thousands of products, crucial to our economy, security, and defense. Facilitating timely access to new and maturing technologies by this large industrial sector is crucial to our future. A new thrust is desperately needed to facilitate technology transfer among many more of the U.S. manufacturers, particularly medium to small companies.

It is the position of the National Centers of Excellence that the majority of U.S. companies eligible to license developing technologies from Federal funding are not even aware of the opportunities. Thus, many excellent new technologies are sitting on the shelf with patent life running out. Even when technologies are licensed, their application is often very narrow because such a limited number of U.S. manufacturers are even aware of the technologies or their potential for improved or new products.

Further Implications

There are additional critical considerations relating to the importance of innovation and the availability of new technologies that affect the viability of the U.S. industrial sector. [Figure 1](#) shows a typical relationship between the market price and production cost of a newly introduced product throughout its life cycle. Note that at initial product introduction, the price is relatively high but declines throughout product life. The same is true for cost. Front-end costs are substantial for re-tooling, training, acquiring equipment, modifying distribution channels and sales methods, etc. These costs decline as the product receives market acceptance and is more widely known and sought after.

Figure 2 shows what happens when a competitor enters the market downstream of the product's introduction. Although the competitor's start-up costs are the same, the market price has declined significantly at that point, resulting in a substantially smaller margin for the original operating entity. If the competitor decides to lower price below the market, even more margin loss can occur.

Figure 3 indicates what happens when a much later competitive entry into the market occurs. Here the competitor's cost of production at the current market price level does not warrant their entering the market, since profits for them are not possible at that market price level.

Figure 4 illustrates an aggressive competitor entering the market. Here the competitor has been able to take advantage of the experience and startup cost curve of the originating company, and begins their competitive operations with significantly lower initial costs. The manufacturing cost advantage is now owned by the competitor, who may be able to force the originating company out of the market solely on the basis of product pricing, while still maintaining adequate profit margins for themselves.

Thus, if new technologies are quickly acquired, successfully integrated into products, and rapidly introduced into good markets, the originating company can see a substantial margin on a new product during its early years. These graphs show that competition will usually arise in the outlying years if a market remains attractive. At that point in time, the original manufacturer should have captured the major benefits from the product, and should be looking to introduce new or enhanced products. This is most often based on further refinement of existing technology or incorporation of new technologies.

Continual change in product features and functions is both a manufacturing challenge and opportunity. Those companies with access to new and maturing technologies can take continuous advantage of substantial margins during each new product's early life cycle. Companies using this strategy need not be nearly as threatened by low margins when such products become commodities. Nor are they as concerned with foreign production and competition. Truly competitive U.S. manufacturers should be continually working on technology transfer so they can introduce new, more attractive and different products or enhancements to capture the profits available in the front end of a new product life cycle.

Historical State Activities

Over the past two decades, states have been investing more than \$300 million per year in activities to enhance the licensable character of maturing technologies developed in universities and other research institutions (state-funded Centers of Excellence are the most prominent examples). However, making technology more licensable provides only half the bridge needed between technology and industry. In many cases the amount of local funding has also not been adequate to complete technology maturation. Most importantly, state efforts have not included meaningful marketing of licensable technologies to medium and small companies. There also remains a lack of appropriate programs to help technology based start-up companies receive the kinds of broad-based assistance they need to become viable.

Needed Initiative for Capitalizing on U.S. Innovation Strengths

In order for the U.S. to take full advantage of its unique innovation and manufacturing capabilities, a "new thrust in innovative technology commercialization" is needed in 3 specific areas:

1. Technology maturation
2. Technology marketing
3. Start up company assistance

1. Technology Maturation. - The strategy is to provide funding to match what states are providing to advance university level technologies toward more licensable products. Augmenting existing programs that are judged effective can help. In addition, this paper proposing moving the technologies into a highly qualified new entity capable of producing commercial prototypes, advancing patents and maturing the technologies to the level of developed products, and then licensing the products out to product producers. This new development entity would represent a repository of skilled individuals and/or consultants who could rapidly mature the technologies into a range of products, all of which could be individually or collectively available for licensing by various product producers.

2. Technology Marketing - A qualified team of professionals, knowledgeable on technology transfer and with substantial manufacturer interface, must be nationally available to successfully accomplish several specific tasks. Adequate resources for these tasks normally don't exist within medium to small companies. First is publicizing the availability of technologies to companies with related products or capabilities. Second is helping prepare a business plan, with strategies for technology implementation that define the feasibility and methodology of incorporating a new technology into a company's existing or future products. Third, after technology licensing, is assisting the entity with implementing the integration of such technology into the production of enhanced existing and new future products. This will involve modification of existing equipment and facilities, training of employees, redesigning of products, and perhaps even the modification of distribution channels and sales methods.

The proposed new entity will be called the Garn Advanced Manufacturing Business Information Technology (GAMBIT) Center. It will have access to individual consultants, consulting firms, higher education institutions, and other resources to assist in facilitating a timely implementation of such technologies. The final stage will be subsequent monitoring of the impact of such new technologies and the benefits to the recipient companies. These steps would make a significant and substantial contribution to moving available new technologies into hundreds, if not thousands, of additional companies each year which otherwise have little or no access to or knowledge of such technologies.

3. Start up Company Assistance – In the past, technology-based start-up companies have emerged quite unpredictably from university technology portfolios. Founders tend to be technicians involved in the technology's development. They're not conversant in business practices. Perhaps most importantly, they tend to have little or no understanding of commercial product design and production methods, or new product servicing. Lack of know-how and resources often causes company growth to stagnate or fail when timely goal accomplishment is not achieved and available funding runs out. Past experience proves start-up companies are a very viable way to commercialize some technologies. New companies should be established around a specific new technology. Here the technology will likely be licensed by joint participation of the technology developers and others. Then professional GAMBIT Center resources need to assist in identifying enterprise-worthy technologies for such start up entities, and to determine what will be needed for the company to become successful.

These three mechanisms would provide the other half of a bridge for aggressively moving maturing technologies into industry. They would mate with state-funded efforts such as Centers of Excellence. Because of the national economic, security and defense implications of rapidly maturing new technologies, not only states, but the federal government have a vested interest in this opportunity for successful technology commercialization. It is therefore proposed that the federal government become a full participant by providing matching funds that are at least equal to state commitments to technology commercialization. Such a program should be initiated through the GAMBIT Center, with a pilot program in a few selected states and then it should be fully implemented nationally.

A Model System

Some years ago, the Washington D.C. office of the New York Times, after considering similar recommendations, wrote an open letter to President Clinton upon his inauguration. The article emphasizes how Utah has taken a leading role in technology commercialization by providing continuous funding for its Centers of Excellence Program since 1987. Because of Utah's recognition and past performance, this program should certainly be included in the selected states for the initial prototype. The Utah model has been adapted and shared with numerous states.

It is also strongly recommended that G. Michael Alder, who at the time of the NY Times article was responsible for the state of Utah Centers of Excellence technology program, should be sought after to manage portions of this new proposed Center. Mr. Alder is currently a managing partner in a private Alabama-based venture fund for high-tech start-up activity. He's also the chairman of WestCAMP,

Inc. that operates the Utah Manufacturing Extension Partnership (MEP). In 1996 the Office of Technology Innovation at the National Institutes of Standards Technology then under the direction of George Lewett, contracted with Alder to do a national study of activities of state-funded technology commercialization programs including Centers of Excellence. That study is now being updated by the National Centers of Excellence and the updated report will be released in October 2005.

The proposed Federal match for the GAMBIT Center doesn't begin to compare with the level of funding for such efforts as the SBIR program. However, the results from the GAMBIT Center will have substantially greater impact on the timely commercialization of maturing technologies throughout the U.S. The proposed jointly funded program (State and Federal) will take advantage of an existing successful model, with local level emphasis vs. a remotely implemented federal program. States are already committed to this effort with unmatched funds. The enhanced functionality that will result from the federal government's participation will generate significant improvement and positive results. Certain elements of the program regarding supporting functions will not be discussed further at this time, but have been considered in substantial detail. They include such activities as:

1. Assessment and qualification of potential technology licensees. This involves establishing and maintaining databases of available technologies and potential licensees. The American Manufacturers' Information Technology Association (AMITA) would be a good resource.
2. Resource pool establishment. These resources compliment local teams so the integration of technologies can rapidly take place. EG&G Services would be an appropriate resource.
3. National services. The overall program must have other services available nationally, such as back office support. An experienced support service provider, knowledgeable about activities of medium to small manufacturers, will be important to program success. Management Services Inc. (MSI) would be an appropriate resource to consider.
4. Management. The overall program must be managed by someone who has been personally involved with and is knowledgeable about industrial sector activities involving the 350,000 medium to small manufacturers. These companies will be key to program success. Someone experienced with the NIST MEP program would be appropriate. This new and aggressive commercialization program may be an appropriate function within the National Institute of Standards Technology; in fact, the GAMBIT Center's program services could be managed by re-establishing the Office of Technology Innovation within NIST.

Summary and Conclusions

The Federal Government's continuing investment in basic and applied research is substantial. Clearly states are making significant local investments to help mature some federally funded technologies so they can be transferred into local economies. Considerable improvement in outcome is possible with a relatively small amount of additional funding and effort in order to implement technology commercialization across the entire U.S. industrial sector. It is therefore strongly recommended that, in order to optimize and accelerate the technology commercialization process that has evolved at the state level, Congress immediately launch a new thrust in innovative technology commercialization by the endorsement and funding of the Garn Advanced Manufacturing Business Information Technology Center. This initiative shall recognize that most technology transfer happens locally. Therefore the Federal Government should provide funds to match what states are already doing in the areas of technology maturation, technology marketing and start up company assistance.

Figure 1. New Manufactured Product Introduction vs. No Competitor

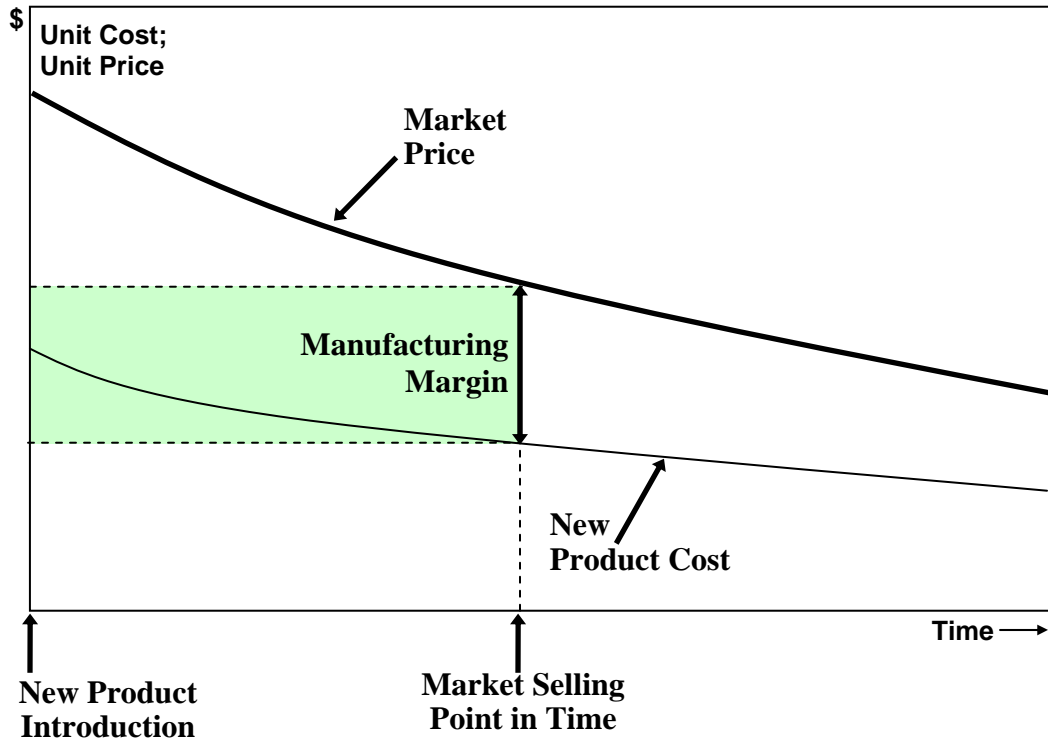


Figure 2. New Manufactured Product Introduction vs. Competitor Entry

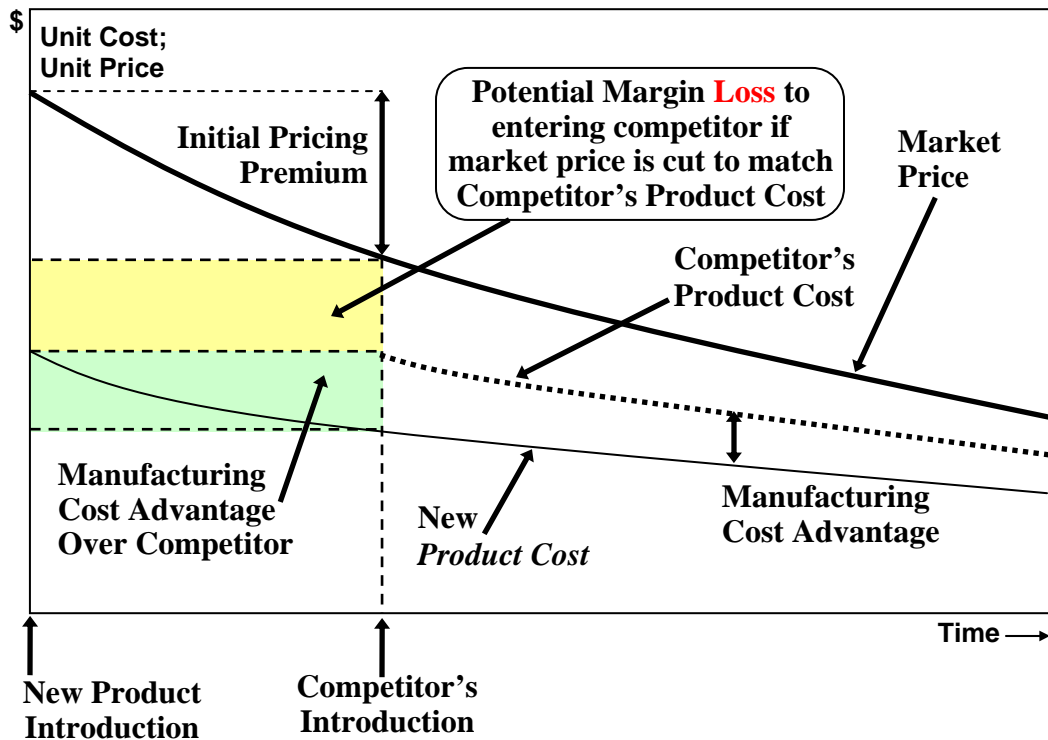


Figure 3. New Manufactured Product Introduction vs. Late Competitor Entry

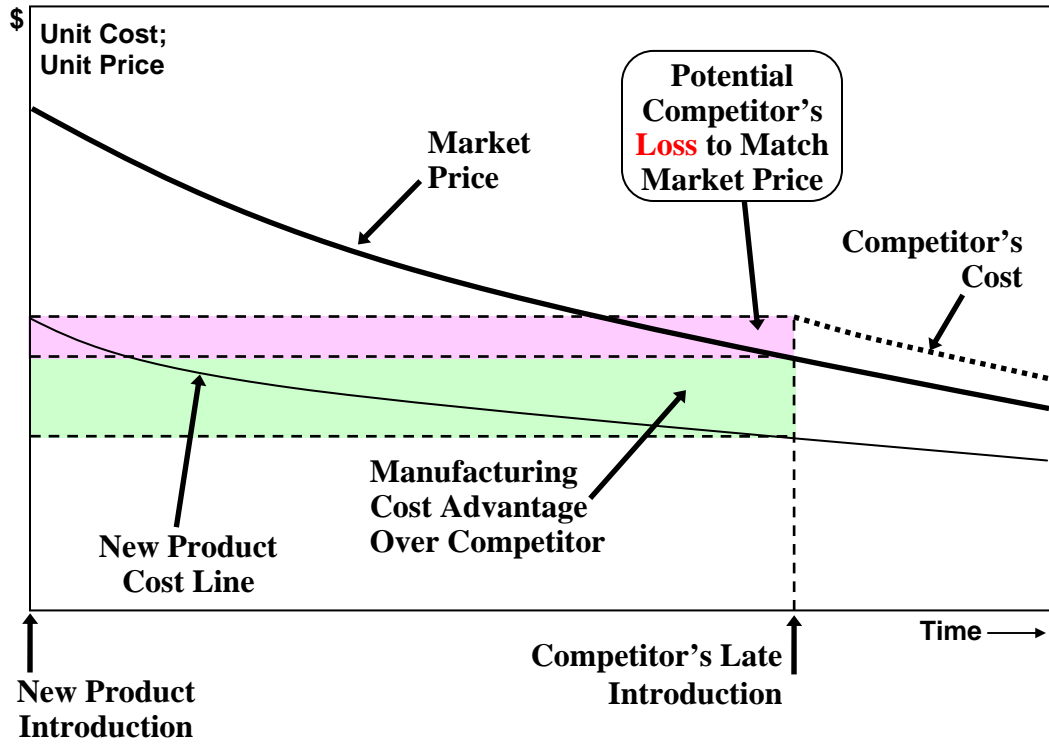


Figure 4. New Manufactured Product Introduction vs. Early Strong Competitor Entry

