

# An Experiment in Stimulating Innovation

*National Science Foundation,  
Universities embark on program to  
assist inventors, entrepreneurs*

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## INTRODUCTION

In mid-1973, the National Science Foundation embarked upon an experiment to test federal incentives for improving the climate for technological innovation. The purpose of the experiment was to test the effectiveness of federally supported university-based innovation centers for research and experimental investigation into the innovation process. The centers were designed to provide students with firsthand observations and project-oriented education in the process of technological innovation. Such an educational experience, it was reasoned, should increase the quantity and quality of university educated entrepreneurs and innovators. In addition, NSF hoped the centers would stimulate new business starts; provide assistance to independent inventors; convert university-based R&D results into new products, processes and services; and provide them systematic insights into the innovation process. With these objectives in mind, NSF funded experimental centers at the University of Oregon, Carnegie-Mellon University, and the Massachusetts Institute of Technology.

## THE INNOVATION PROCESS

The worldwide investment in innovation is immense. In the United States alone, total R&D expenditures amount to about \$37.7 billion. Of this, an estimated \$11.9 billion to \$15.5 billion is spent by U.S. firms in search for new products.<sup>1</sup> Actually, the total cost of this corporate search for new products may be closer to \$39.7 to \$51.7 billion.<sup>2</sup> Yet, between 50%<sup>3</sup> to 80%<sup>4</sup> of these products will fail in the marketplace.

To a large degree these failures occur because there is little systematic knowledge concerning the innovation process. Costly mistakes are made by companies and entrepreneurs venturing to exploit a new product and failing because a significant facet of the innovation process has been overlooked.

Two factors contribute significantly to this rather back-  
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ward state. First, our knowledge of the innovation process is in a state of primacy in the sense that it consists largely of pure reasoning which is based on observation of the natural phenomena without much help from controlled experiments. This approach has led to many well-known and long-cherished — but fallacious (and sometimes fatal) — beliefs. Secondly, the innovation process is not well suited to academic analysis. In every professional school, instruction is organized along discipline-oriented lines. In engineering schools, students are introduced to mission-oriented thinking by means of a design project, and usually end their explorations into innovation at the design. Rarely do they reach into prototype construction, determination of manufacturing costs, market analysis, or the preparation of a business plan. On the other hand, business school teaching is fragmented into traditional departments of marketing, management finance, and accounting. Business students seldom reach back into the technological phase of the process, and their theories and concepts are rarely put to the acid test of getting a new product or process into the marketplace.

## THE INNOVATION CENTERS

The Innovation Centers are designed to correct these deficiencies. Engineering students are thrust forward into the commercialization phase of the innovation process and business students are forced back into the technological status of new-product development. Both groups are not only exposed to an interdisciplinary study of innovation; they are taken out of the classroom and exposed to the real problems of generating, developing, and introducing new products. At present, the three centers are not fully interdisciplinary. The MIT and Carnegie-Mellon Centers draw students largely from their respective engineering schools, whereas the Oregon Center attracts mostly business students.

## AN EVALUATION

It was hoped that the centers would:

- Increase the quantity and quality of entrepreneurs and innovators.
- Stimulate new business starts.
- Provide assistance to independent inventors.
- Produce new products, processes, and services.
- Provide some systematic insights into the innovation process.

Although the centers have been in operation for only two and a half years, results are beginning to emerge. Obviously, qualitative measurements require the test of time. However, information of a quantitative nature is available. Some data indicate the centers may be increasing in

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quantity, if not the quality, of entrepreneurs and innovators generated by their program. A recently completed, but unpublished survey of Oregon alumni who graduated between 1970 and 1974 indicates that those students who took at least one innovation-related course had a significantly higher involvement in entrepreneurial activities than those who did not. Twenty-six percent of the "innovators" had held at least partial ownership in a firm in contrast to 15% for those who had pursued a more traditional curriculum.<sup>5</sup>

Since their inception, the centers have been instrumental in helping establish 20 new ventures. Carnegie-Mellon is perhaps most active in this area, being responsible for establishing nine of these new firms and having been instrumental in assisting several firms to obtain venture capital. The extent to which these firms will grow and prosper is yet to be determined. However, at the end of 1975 these firms were employing 240 persons and had a cumulative 1974-75 sales of nearly \$3.5 million.<sup>6</sup>

## Independent Inventors

Independent inventors are an important source of technological innovation.<sup>7</sup> In the first two years the centers assisted over 1,200 independent inventors. The bulk of these were assisted by the Oregon Center which developed a special 29-factor preliminary evaluation system to evaluate the ideas and inventions of inventors.<sup>8</sup> In addition, the Oregon Center is working on developing effective and efficient means of transferring technology from the independent sector to the entrepreneurial and corporate sectors of the economy.

It is too early to determine the extent to which new products developed at the centers will be long-term successes. However, 25 new products were developed and introduced into the marketplace by the centers or by center clients. The product with perhaps the greatest dollar sales potential is a consumer electronics device developed by an MIT student. Student involvement in this project, however, did not cease with generation of the idea. The inventor and several of his fellow students are following the product through the entire innovation process and to the marketplace.

As previously stated, many if not most new products fail. This means that a substantial portion of our investment in innovation — perhaps as much as two-thirds<sup>9</sup> or more — is wasted or used inefficiently. Again, as indicated earlier, a substantial portion of this waste may be

because we have an inadequate understanding of the innovation process. To the extent that the Centers can shed some light on the backward art, research outputs could be among their most important products.<sup>10</sup>

## CONCLUSION

The Innovation Centers do not occupy a permanent niche in academia. They are experimental. The extent to which these centers and others like them become permanent will depend, in part, upon the business and technological communities' interest in this innovative approach to educating innovators and stimulating the flow of technological innovation. The interdisciplinary approach to innovation, coupled with the opportunity to apply classroom theories and concepts to real life situations, should permit the centers to obtain their main goal of increasing the quality and quantity of entrepreneurs and innovators.

## NOTES

1. National Science Foundation, *National Patterns of R&D Resources*, Washington, D.C. U.S. Government Printing Office, 1973.

2. This is based on the estimate that R&D expenditures represent only about 30% of the total cost of a developing new product.

3. Booz, Allen, and Hamilton, "A Program for New Product Evaluation" in *Product Strategy and Management*, Ed. by Thomas L. Berg and Abe Shuchman, New York: Holt, Rhinehart, and Winston, Inc., 1965.

4. "New Products, The Push is on Marketing". *Business Week*, March 4, 1972.

5. The mean time these alumni had been out of school was 2.5 years. The difference cited is significant at the .03 level.

6. National Science Foundation, Office of the Experimental R&D Incentives Program, 1973.

7. See Jerkes, John et. al., *The Sources of Invention*, New York; St. Martins Press, 1959; Sollanoff, Lois, "The Innovation Myth", individual Research August 9, 1971; or Scher, F. M., *Industrial Market Student and Economic Performance*, Chicago: Rand McNally, 1970.

8. For more information see Udel, Gerald G., "The Essential Nature of the Idea Brokerage Function", *Journal of the Patent Office Society*, October 1975.

9. Booz, Allen and Hamilton, op. cit.

10. For more information about the Exploration Series, Contact the Innovation Center, University of Oregon, Eugene, Oregon 97403. Some research results are beginning to appear. For example, the Oregon Center has begun to publish a series of monographs, working papers and reprints entitled: *Explorations in Invention and Innovation*.

## Erratum

Salvatore R. Conte, who authored the article "Licensing an Aid to Pharmaceuticals" in the March 1976 *Les Nouvelles*, was inappropriately identified. Mr. Conte is a patent counsel with Johnson & Johnson, New Brunswick, N.J. The editors regret the error.