TECHNOLOGICAL INNOVATION THROUGH ENTREPRENEURSHIP

Cases are examined from an experiment to stimulate technological innovation through entrepreneurship.

by Robert M. Colton

Program Manager
National Science Foundation
Washington, D.C. 20550
202/634-6204

An entrepreneur, according to Webster, is an organizer of an economic venture, expecially one who owns, manages, and assumes the risk of a business. Donald Dewey suggests that, "It is generally accepted that entrepreneurship consists of the meeting of uncertainty."

If one wants innovation to occur, find an entrepreneur -- if you can -- a prime conclusion of a 1973 study of ten major innovations by Batelle Memorial Institute (1).

Economists Edwin Mansfield (2, 3) and Morris Boretsky (4) have published extensive econometric data indicating that the return on investment in technological innovation, measured in terms of economic growth, exceeds that achieved from most other stimulators, such as capital investment in plant and equipment.

Yet with the recognized need for innovation and entrepreneurship (5), the avoidance of risk, fear of failure, and reduction of venture capital accessibility (6) are becoming so pervasive that in the not-too-distant future, innovation and entrepreneurship may well be looked upon with nostalgia.

Fortunately, there are some silver linings. A series of articles on education for the world of work appearing in Fortune Magazine (7) references an increasing number of university, institutional, and industrial programs that are meeting risk head on by providing increased opportunities to enter the business world and initiate new ventures. Roger Ricklefs, in the Wall Street Journal reported in early 1976 that business school enrollments have doubled in the last three or four years, outpacing most other major fields of instruction; this trend may be indicative of an increased desire to enter the potentially lucrative, albeit uncertain, world of entrepreneurship. Karl Vesper of the University of Washington, in a report on Venture Initiation Courses in U.S. Schools (8), points out that in the 1967-76 period, the number of institutions offering such courses had increased from about 20 to 70 and the number of students enrolled in these courses increased from 1,000 to over 3,000. Vesper estimates that in 1977, over 100 institutions will be offering venture initiation and innovation courses -- substantive indications that entrepreneurship may have a strong basis for a resurgence. A large proportion of Vesper's statistics are manifested in a National Science Foundation experiment (9, 10) whose goals are to stimulate and research entrepreneurship and innovation through experimental Innovation Centers.

In all, 700 entrepreneur-oriented students enrolled in 25 new venture courses and 54 faculty members and 46 community associates are participating in the experiment at three university-based Innovation Centers. The prime objective of the experiment is to determine if the combination of formal classroom training in engineering and business theory and hands-on clinical experience in generating new ideas, developing and evaluating new products and initiating new ventures can increase the quantity and probability of the Innovation Center participants becoming successful entrepreneurs. It is expected that this in turn would positively affect the rate of new product introduction into the commercial market. The Center participants will be tracked and compared with other groups not associated with the Center (11) for a number of years prior to and after leaving the Center to compare their entrepreneurial propensity and achievements, thus providing a measure of the effectiveness of the Center program.

At the halfway point of this five-year experiment (June 1973 - June 3 1978), Centers located at MIT, Carnegie-Mellon University, and the University of Oregon have played a major role (12) in the development of 27 new products and 24 new business ventures staffed with 33 Center-trained entrepreneurs and having projected total gross sales of $30,000,000 in 1976. In total, almost 800 new jobs will have been created during 1976 to staff and furnish components and services for the 24 ventures. These statistics represent the accomplishments of only 5% of the past and current Center participants. As we examine the activities of the remaining 95% of the participants, it is expected that even more significant entrepreneurial activity will be observed. A summary of the performance data for all Centers is shown in Table I a & b.

CASE STUDIES

The primary thread that ties together the educational, product development and entrepreneurial activities of the Innovation Centers are the ideas, generated both internal and external to the Center, that many times mature into marketable products. Once an idea has progressed through the evaluation and development stages of one of the Centers and appears to be a marketable product, it is considered a case. A summary of the 27 active cases at the Innovation Centers indicating Center, major area of Center interest, product developed, companies iniciated, sales and capitalization realized, and new job opportunities created is shown in Table II.

The following three case studies that will be described in detail (Cases 3M, 6M, and 6C - Table II) are representative of two of the three major Center Areas of Interest described in detail later in this article and are associated with the more successful product developments.

Case 3M (Area II - Career Training) Product: Capacitance Meter

Innovation Center - Massachusetts Institute of Technology
Cambridge, Massachusetts

Catalyst:

The catalyst for this innovation was the MIT Innovation Center brochure published in 1973 describing Course No. 06S07 - An Undergraduate Seminar entitled, "Introduction to Innovation," as follows: "This seminar is for the student who wants to become an inventor or entrepreneur, i.e., to patent an invention, develop an idea into a product, or start a new enterprise. New innovations required by social need will be identified. There will be association with other students whose innovation projects are in various stages of completion. Instructors: W. C. Flowers, O. H. Hammond, W. M. Hollister, F. F. Lee."

Scenario:

In 1973, Richard Eckhardt (currently Vice President of ECD Corporation of Cambridge, Massachusetts), a junior at MIT, already had a vision of starting a company. Eckhardt had a bent for electronics and felt there was a ready market for electrical property measurement instruments requiring a minimum of manipulation to obtain accurate readings and having low maintenance.

He focussed on a capacitance meter (Figure 1) that would be autoranging [10 ranges of capacitance (10^{-11} - 10^{-1} farads) automatically selected], have an easily readable liquid crystal digital display, have no external power sources (battery operated with minimum power drain -- 10,000 readings without a battery change), be inexpensive (under $300), simple to operate (pushbutton control), and easy to maintain (all solid state). The needs were known; however his lack of experience to put it all together and initiate a business was self-evident.

As a result of his exposure to the Innovation Center brochure and syllabus of Center-offered courses, Eckhardt enrolled in several courses during 1973 and 1974 emphasizing the development of products and starting a new business. With the proper guidance and encouragement, establishing a business was found to be less of a burden than he anticipated.

Eckhardt has stated that he, "found these courses among the most valuable of any that (he had) taken at MIT. Because of the practical nature of the courses and the first-hand discussions with other entrepreneurs, it (was) possible to anticipate and understand many problems before they occur(red)." Following graduation from MIT in June 1974, Eckhardt set up ECD Corporation in the basement of 232 Broadway, Cambridge, Massachusetts. ECD was capitalized for $21,000 and has 32 full-time employees who produced 4,000 units grossing $1,000,000 in 1976. ECD plans on recapitalizing in 1977 and moving into larger quarters in anticipation of increased sales.

<u>Case 6M (Area III - Resource Availability) Product: Electronic Game</u>

Innovation Center - Massachusetts Institute of Technology
Cambridge, Massachusetts

<u>Catalyst:</u>

The catalyst for this innovation was the <u>Wall Street Journal</u> front page article of January 22, 1975, entitled, "MIT Hopes to Make Itself the Mother of Salable Inventions," by Patricia Sagon. Half-way through this article that generally describes products developed by the MIT Innovation Center, one finds a description of "Joseph Okar's Electronics Game Kit" that connects easily to a television antenna to "broadcast the game on an ordinary TV set, ... that he ... hopes to market ... for $50.00, about half the price of electronic game screens imported from Japah, which don't rig up to one's livingroom TV."

<u>Scenario:</u>

Peter Stepanek, a Boston businessman and president of Executive Games, Inc., a distributor of sophisticated games, read this article with more than passing interest. He, like Okar, had been preoccupied over the past few months in devising a way to develop and market a similar, low-cost television game. Stepanek knew the market (he grossed $20 million in sales for similar games over the past year), had more than "gut" feelings for the performance characteristics and pricing needed to capture a new and larger audience for similar TV games, but lacked the technical know-how and resources necessary to develop such a low-cost set. Stepanek, a top executive in a small business, like many in his situation, could not afford an in-house R&D facility. However, the potential availability of the MIT resources, comparable in many ways to that of a General Motors or Westinghouse, was extremely enticing. Y. T. Li, Director of the MIT Innovation Center, corroborated the availability of the Center resources and within two weeks, Peter Stepanek was an industrial sponsor of the Center (industrial sponsors pay for all services rendered by the Center) with an investment of $35,000. A team of six electrical engineering students initiated the development of a new TV tennis game, while gaining first-hand experience in the innovation process from idea conception through engineering design and prototype construction and finally to production scheduling and marketing of the finished product. In addition to paying for services, Stepanek agreed to provide 5% of the manufacturer's net sales of the finished product to the Center and the six student inventors in return for a limited term exclusive license on the ensuing patent.

Within three months of the initial meeting and agreement, a breadboard model and subsequent prototype (Figure 2) had been completed. The finished product exhibited Joseph Okar's game's basic characteristics.

The student inventors had developed a television tennis game with an independent ball speed control, a means to vary ball return direction, a practice board, and a robot player. The game could thus be played by one or two players or placed on automatic for demonstration purposes.

Stepanek had since finalized negotiations for the purchase of component parts and subsequent manufacture to fill orders for 60,000 units retailing at $70.00 per unit, an impressive gross of $4,200,000.

Five percent of the manufacturer's net sales ($120,000) will go to the Center and to the student developers. Stepanek, himself, is anticipating a profit of $500,000, a reasonable return on his original $35,000 investment. A second investment of $20,000 with the Center for a second generation set is well on its way towards grossing an additional $5,000,000. Stepanek will have increased his gross sales by 25% in 1976 as a result of using Innovation Center resources.

The production of both sets is being conducted in a rented building in the Baker Chocolate Factor in Dorchester, Massachusetts, that up to the present time has had little use. One hundred previously unemployed Dorchester residents will have completed the 60,000 assemblies for the first generation set by the end of 1976 and the 60,000 second generation sets by early 1977. In addition, approximately 400 employees have been hired by other manufacturers to furnish parts and sub-assemblies to the Dorchester assembly facility.

As a consequence of the MIT developments, the retail cost of "television games" has been reduced from over $100 in 1975 to $50-75 in 1977, the number of manufacturers has more than doubled, and the versatility and performance of the games have markedly increased.

Case 6C (Area III - Resource Availability) Product: Security Devices

Innovation Center - Carnegie-Mellon University (CMU)
Pittsburgh, Pennsylvania

Catalyst:

The catalysts for this innovation were the following quotes from the CMU Center for Entrepreneurial Development (CED) brochure: "CED is a university-affiliated voice for technological innovation and entrepreneurship. CED works with venture capital companies. CED opens doors to public and private support of innovators and entrepreneurs. CED maintains close association with investment institutions and the banking community."

Scenario:

Romesh Wadhwani, a native of India, came to CMU in 1969 to earn his Ph.D. in bio-medical systems. Shortly after his arrival, he became acquainted with K. S. Pribadi, a CMU faculty member, and in 1972, they teamed up to form and incorporate Compu-Guard Security Systems, Inc. (formally incorporated in June 1973). Their goal was to capture a fair share of the security device market with a technology, they felt, far surpassing that of their rivals. They devised hardware incorporating mini- and micro-computers that do the "thinking" with programming that makes the system practical. A typical Compu-Guard system consists of sensors, guarding a door or window, connected to a relay unit that activates a computerized central station that produces an appropriate response or warning.

An intruder or, in the case of fire, smoke would be sensed, activating the relay that eventually would produce a warning signal at a central station. An add-on to the system would consist of a wrist-type transmitter (Figure 3) worn by a guard or other person needing protection. Activation would be achieved by pressing a button on the transmitter that would send out a coded signal. A series of well-situated receiver stations would identify the wearer.

Wadhwani and his Indonesian partner were on top of the technology and the market; however, there was a cash flow problem that threatened to interrupt the final phases of their test and development program. Additionally, there was a distinct possibility that even if Compu-Guard were awarded a contract to develop a security system, sufficient credit would not be available to purchase component parts or even pay employee salaries. At that point, Wadhwani became aware of the Center services through its brochure, contacted the Center, and then enlisted its assistance. The Center provided the R&D resources to share of the security device market with a technology, they felt, far surpassing that of their rivals. They devised hardware incorporating mini- and micro-computers that do the "thinking" with programming that makes the system practical. A typical Compu-Guard system consists of sensors, guarding a door or window, connected to a relay unit that activates a computerized central station that produces an appropriate response or warning.

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The Center received 6% of Compu-Guard stock for these services and their note for repayment for the use of R&D resources. During 1975, Compu-Guard had sales deliveries of approximately $25,000 on gross sales of over $800,000, anticipates 1976 sales deliveries exceeding $1,000,000, and has a backlog of orders of over $10,000,000. This major backlog reflects Compu-Guard's recent expansion in coverage to include the manufacture and installation of a computerized energy conservation system for heating and cooling of commercial structures. Compu-Guard currently has 58 employees, including eight from the Innovation Center. An additional investment of $200,000 for expansion to meet the rapidly increasing backlog has recently been negotiated, and additional financing in the order of $1,500,000, that will be raised via public or private offering, is in the offing.

ECONOMIC PERFORMANCE OF THE INNOVATION CENTERS

These three case studies represent a small, albeit successful, fraction of the Center cases. If one examines the total economic impact of these Centers, it is found that in 1976 alone the federal taxes collected as a result of the profits and wages attributed to the new ventures initiated by the Centers will exceed $6,000,000; approximately ten times the annual federal investment of $670,000. Details of these econometric performance factors, recorded for all Centers on an annual basis, are shown in Table III.

MAJOR AREAS OF CENTER INTEREST

The Centers have now passed their third anniversaries and expect to achieve a self-sustaining status by June 1978 through university and industrial support, income generated from licensing new products and equity investment in the new business ventures initiated, and grants from public and private foundations.

In providing training and assistance to the entrepreneurs for developing new products and initiating new businesses, several specific functional areas are emphasized at the Centers. As a consequence, each new product developed or venture initiated, as shown on Table II, can be related directly to one or more of the following areas.

Area I - Invention Evaluation and Market Development

In this area, services are available to independent inventors and existing businesses, and to develop new products and services that can be a basis for new venture initiation or licensed to existing business for growth purposes. The evaluations are formal and are integrated into the training program. Center resources can be made available to exploit those products and services having commercial potential.

Where a new venture results or an existing business expands, equity positions can be obtained by students, faculty, and the Center itself in return for services provided.

Area II - Career Training

This area mainly consists of classroom (theoretical) instruction and laboratory (practical) courses. Table IV lists the various courses offered at each Center. The instruction emphasizes idea generation, evaluation, actual product development, business planning, and marketing. Consequently, potential entrepreneurs, innovators, inventors, and product evaluators can receive training and related experience at a Center in order to (a) increase their potential for initiating successful new ventures; (b) improve their evaluation capabilities for selecting potentially successful new products and services for existing businesses; and (c) increase their performance in existing businesses either as owner or employee through the generation of new ideas, development of new products and improvement in their management capabilities.

The primary purpose of this training program is to reduce the time it takes to become a successful entrepreneur and to increase their numbers. The uniqueness of the approach, however, is that during the training period, a new product may be developed in the laboratory that can be licensed to an existing business or be the basis for initiating a new venture or expanding an existing one. As in Area I, the student developers may share in royalties from the licensing or take equity in the new ventures.

Area III - Resource Availability to New and Existing Businesses

In this area, new ventures can be "seeded" or existing businesses enhanced through the availability and use of (a) R&D facilities, (b) idea and product development capabilities, and (c) management assistance and business planning programs. Up to $40,000 in services can be furnished to a new venture for seeding purposes.

Additionally, existing businesses with limited R&D capabilities, but innovative in spirit, are encouraged as industrial sponsors to utilize the available Center resources. An industrial sponsor contributes significant funding to finance the services desired. The cost for such sponsorship may range from $5-25,000. The products developed using these reosources are integrated into the laboratory training program and, again, the students involved may share in royalties, take equity, or participate in the resulting business.

THE OUTLOOK

In examining the performance of the Centers to date, it should be kept in mind that the cases and Center functions and areas of interest described in this article are concerned with Innovation Centers that are still experimental. The testing of the concept that entrepreneurs and growth-oriented businesses having limited resources but potentially high technical capabilities can be materially assisted by self-sustaining Centers is still in progress. Even with the achievements described in this article, validation of the concept will no doubt require several more years of continuing measurement and evaluation. However, it is

References

(1) Samuel Globe, Charles M. Schwartz, & Girard W. Levy, "Final Report, Interaction of Science and Technology In the Innovative Process: Some Case Studies," Battelle Columbus Laboratories, Report NSF-C-667, 1973.

(2) Edwin Mansfield, Industrial Research and Technological Innovation; an Economic Analysis, 1st edition, New York, Norton, 1968.

(3) Edwin Mansfield, The Economics of Technological Change, 1st edition, New Yrok, W. W. Norton, 1968.

(4) Michael Boretsky, U.S. Technology; Trends and Policy Issues, Washington Program of Policy Studies in Science and Technology, George Washington University, 1973 (Monograph No. 17).

(5) Small Enterprise in the Economy, U.S. Small Business Administration, Office of Advocacy, Planning, and Research, September 1975.

(6) The Breakdown in U.S. Innovation, Business Week, February 16, 1976.

(7) Walter Guzzardi, Jr., "The Uncertain Passage from College to Job," Fortune, January 1976.

(8) Karl Vesper, Venture Initiation Courses in U.S. Schools, University of Washington (NSF Grant DI43539), 1975.

(9) Robert M. Colton & Gerald G. Udell, Journal of Small Business Management, Volume 14, No. 2 (April 1976).

(10) Gerand G. Udell & Robert M. Colton, Journal of the Licensing Executives Society, Volume XI, No. 2 (June 1976).

(11) Survey Instruments for Tracking Status of Center Participants, National Science Foundation, 1975
a) Student Views Instrument
b) Career Pattern Instrument.

(12) Survey Instruments for Tracking Center Progress and Performance, National Science Foundation, 1975.

TABLE Ia

INNOVATION CENTERS

Performance Data

(Participation and Courses)

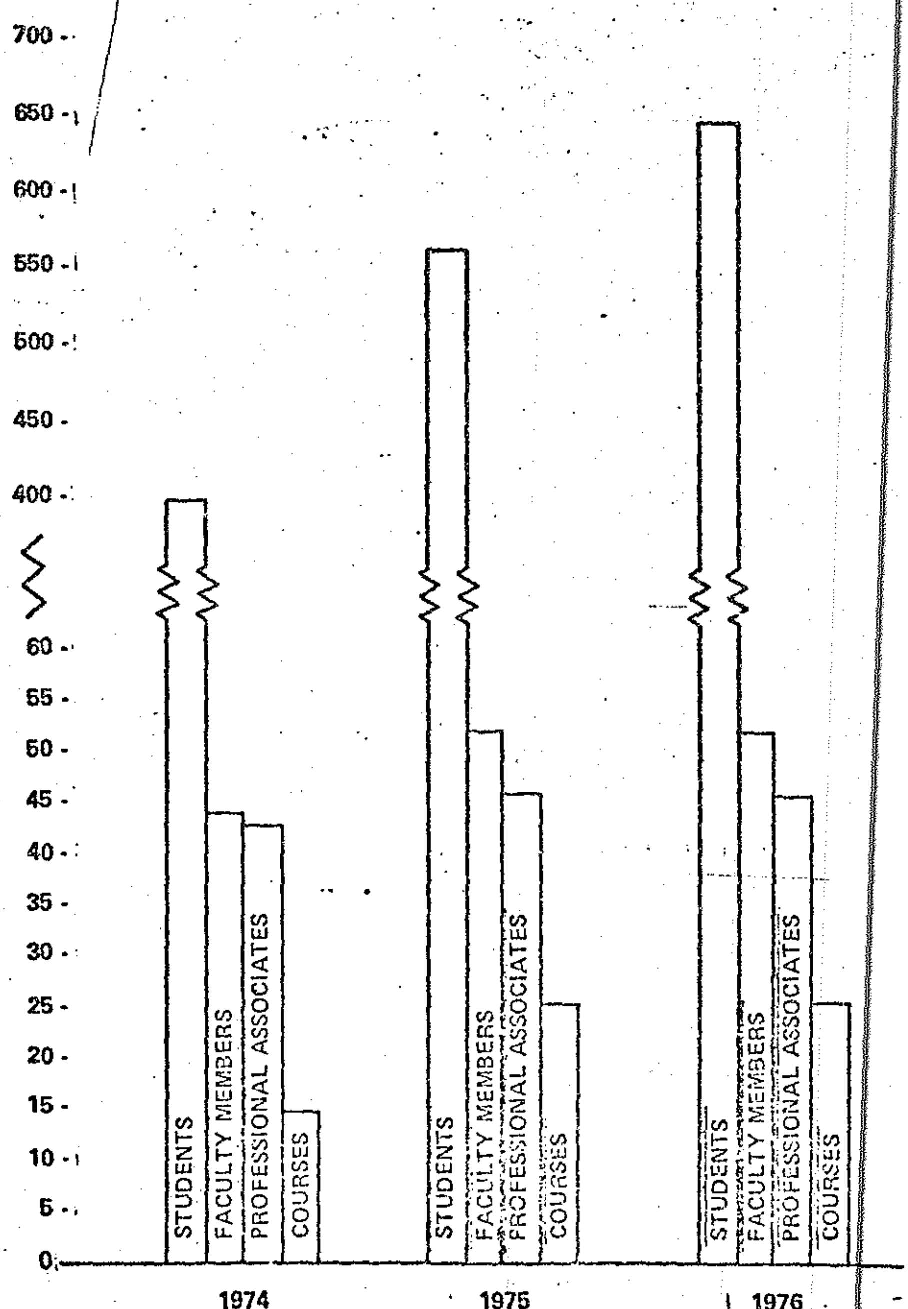


TABLE Ib

INNOVATION CENTERS

Performance Data

(Projects and Employment)

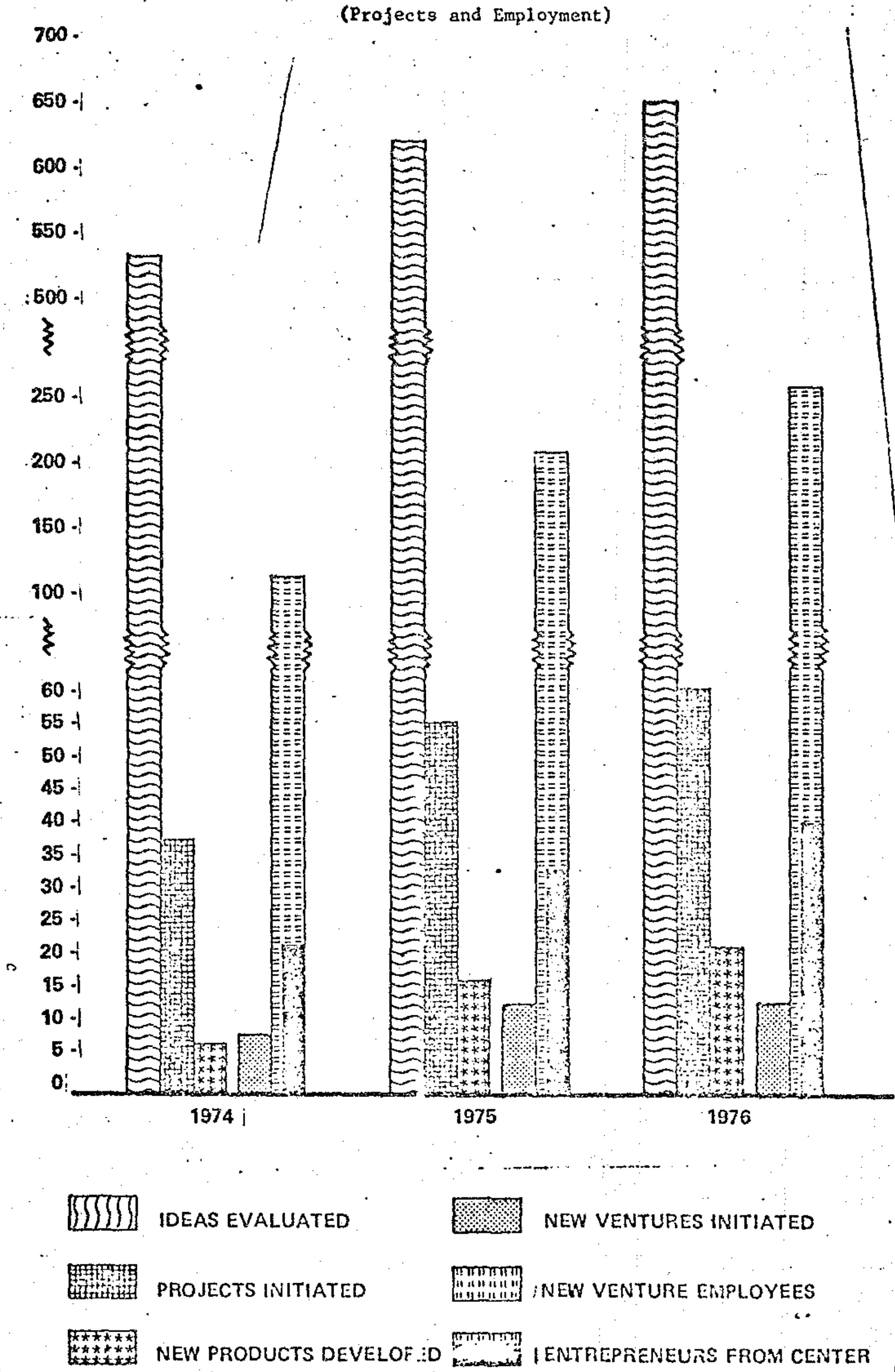


TABLE II

INNOVATION CENTER CASES - 1974/76

CASE NUMBER	CENTER	MAJOR AREA OF INTEREST(2)	1974/76 PRODUCT	1974/76 COMPANY	1974/76 CENTER INVESTMENT	1974/76 (1) SALES	1974/76 CAPITALIZATION LOANS	1974/76 CAPITALIZATION INVESTMENTS	1974/76 (1) EMPLOYEES
1M	MIT	III	Current [illegible] device	Semtel	$ 0	$1,000,000	$ -	$ -	40
2M	MIT	II	Bicycle framesets	Klein Corporation	13,000	1,200	20,000	2,800	2
3M	MIT	II/III	Electronic games	Interglobal, Ltd. (Kemtech, Inc.)	0	10,000,000	-	35,000	100(3
4M	MIT	II	Precious metal counterfeit detector	Hetra Corporation	0	500,000	-	20,000	5
5M	MIT	II	Wide band musical instrument	Three licenses	30,000	500,000	-	-	50
6M	MIT	II	Capacitance meter	ECD Corporation	0	1,000,000	11,000	10,000	20
7M	MIT	II	Compound bow	AMF Corp. (License)	0	-	-	20,000	--
8M	MIT	II	Pulse width amplifier	Koss Corp. (License)	0	-	-	27,000	--
1R	ORE	I	Wood burning stove	Fisher Stoves, Inc.	0	N/A	-	10,000	3
2R	ORE	I	Three wheel car	Transportation Concepts, Inc.	0	50,000	-	40,000	6
3R	ORE	I	Gold ore	Rare Ore, Inc.	0	2,000	-	500	6
4R	ORE	I	Nite trainer	Royal Industries	0	N/A	-	5,000	1
5R	ORE	I	Research and consulting services	MBA Consultants	0	4,500	-	-	15
6R	ORE	I	Tempa-bath	CCC Plumbing	0	N/A	-	7,500	--
7R	ORE	I	Cedar-mill wine rack	Redi-Grill	0	N/A	-	10,000	--
8[illegible]	ORE	I	Thermocycle	Thermocycle, Inc.	0	N/A	-	-	--
[illegible]	ORE	I	Guyton table	SICO (License)	0	6,500,000(5)	-	-	--(4
1C	CMU	III	Newspapers (printing technique)	Pittsburgh New Sun	1,000	95,000	-	2,000	9
2C	CMU	III	Transportation and related equipment (computerized meters)	Peoples Cab Co.	0	200,000	92,000	18,000	35
3C	CMU	III	Blood diagnostic	Bactex Corp.	20,000	N/A	-	5,000	15
4C	CMU	III	Specialty computer hardware	Three Rivers Computers, Inc.	500	90,000	-	5,000	5
5C	CMU	III	Blood oximeter	Jessika Oximeter	40,000	N/A	-	4,000	3
6C	CMU	III	Security devices	Compu-Guard, Inc.	40,000	10,000,000	200,000	650,000	58(
7C	CMU	III	Long life lighting	Internaitonal Lamp Corporation	500	N/A	-	-	--
8C	CMU	III	Timesharing	Transcomm	0	500,000	-	102,000	14
9C	CMU	III	Prosthetics	Rehabilitation	35,000	N/A	-	-	2
10C	CMU	III	Remote control devices	Vectron	40,000	-	-	-	3
	Totals		27	29	220,000	30,442,700	323,000	973,000	392

(1) Includes potential for 1976.
(2) I - Invention evaluation and market development;
II - Career training;
III - Resource availability to new and existing businesses.

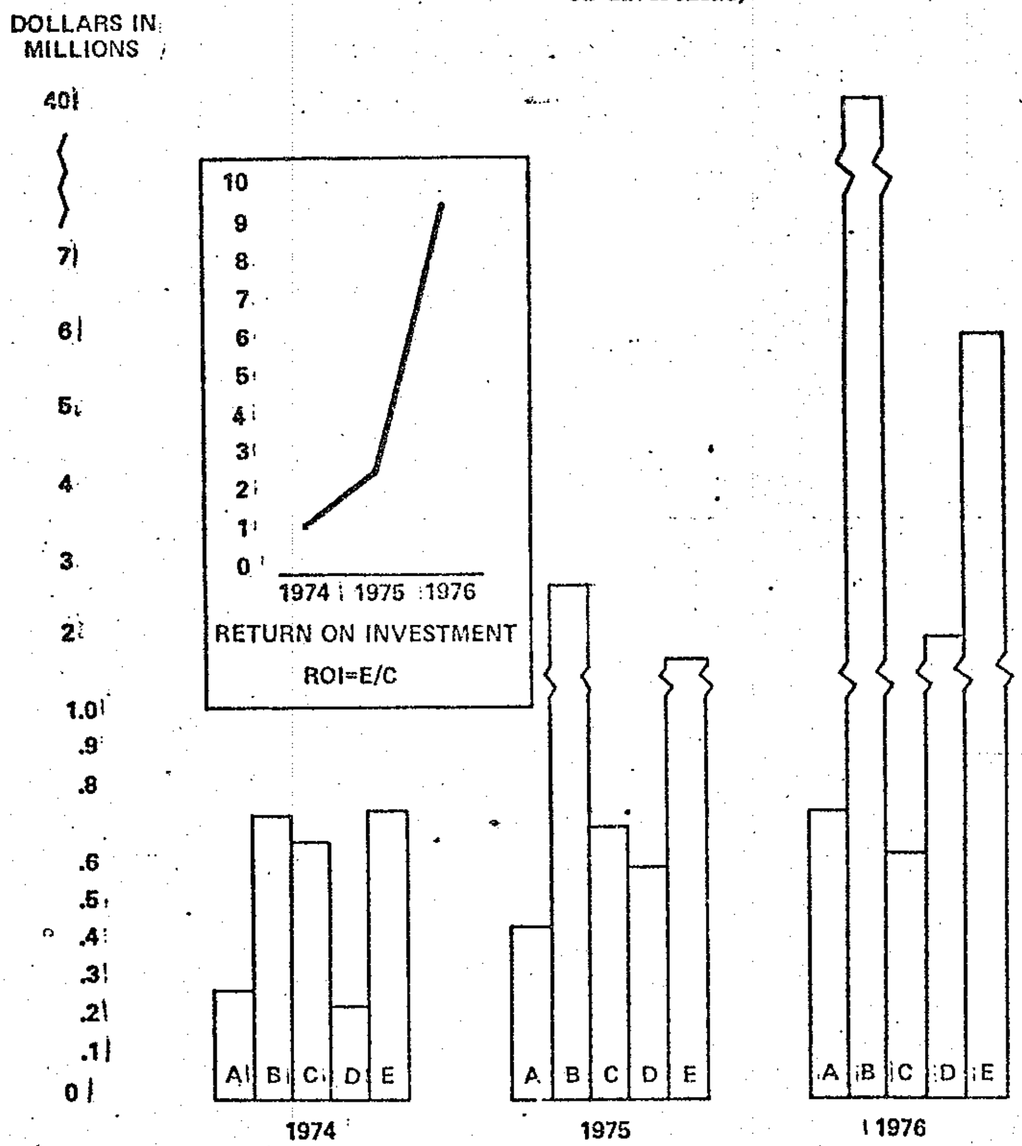
(3) 500 additional employees at sub-contractor facilities.
(4) 100 additional employees at SICO facilities
(5) Royalties-- $200,000 est. ($65,000 guaranteed)

TABLE III

INNOVATION CENTERS

Econometric Data

(Financial and Return on Investment)



A. = PRIVATE VENTURE CAPITAL INVESTED

B. = NEW VENTURE SALES

C. = NSF FUNDING

D. = ESTIMATED FEDERAL TAXES FROM NEW VENTURE EMPLOYEES & PROFITS

E. = ESTIMATED FEDERAL TAXES FROM DISTRIBUTION OF WAGES & PROFITS

TABLE IV

COURSES OFFERED AT INNOVATION CENTERS

Center	Course Title
Carnegie-Mellon University	- Design and Entrepreneurship - Management of Technological Innovation - Problems in Small Business - Engineering Economics - Management Strategy - Financial Accounting and Control Systems - Management Invormation and Control Systems - Production - Marketing - Cost Estimation and Analysis
Massachusetts Institute of Technology	- Undergraduate Seminar - Introduction to Innovation - Invention Development Laboratory - Invention - Internship in New Enterprise Development - Entrepreneurship
University of Oregon	- Management and Innovation - Applied Innovation I - Applied Innovation II - Applied Innovation IIB - Small Business Management - Entrepreneurship - MGT Research and Development - Venture Finance - Marketing Innovations

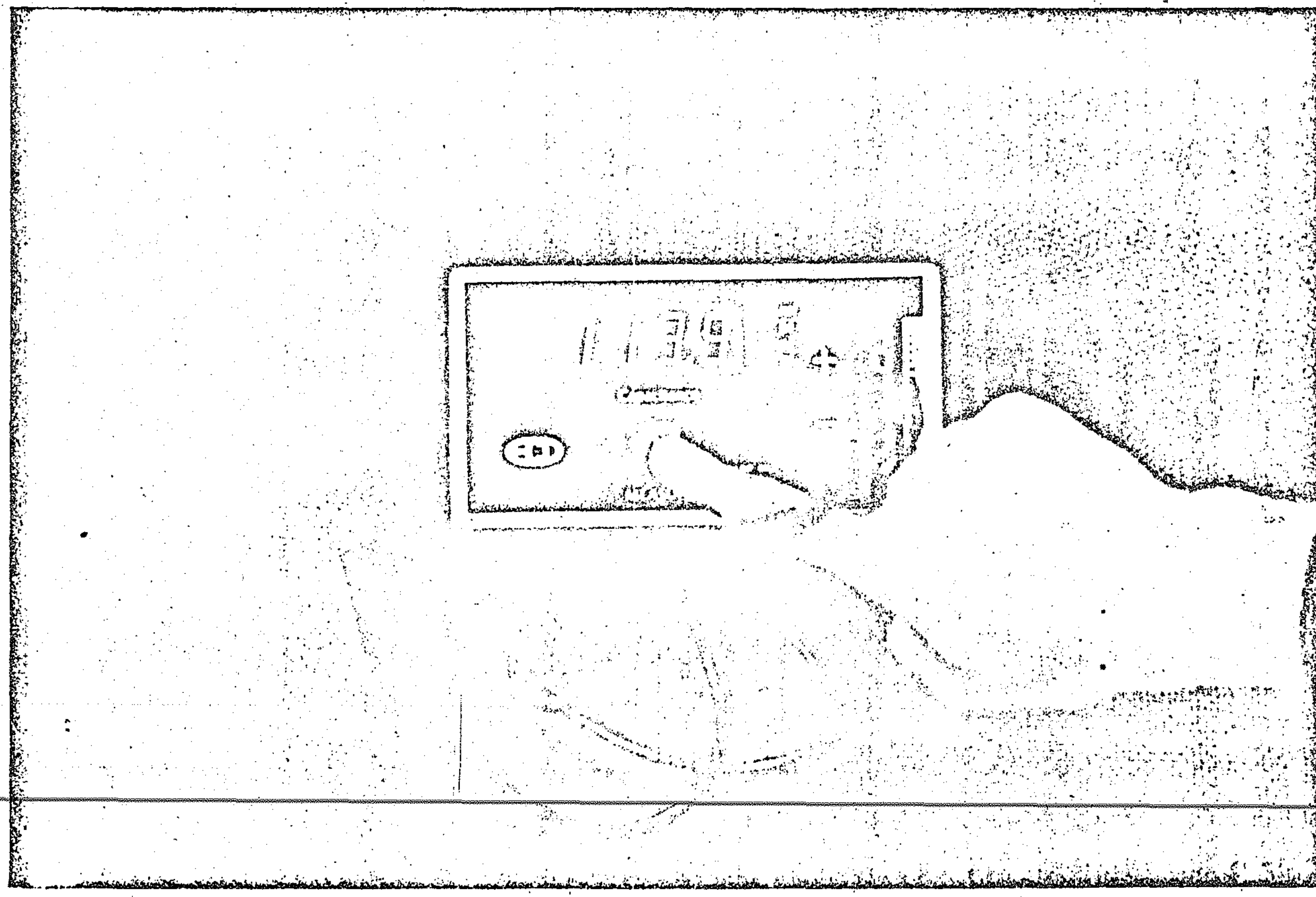


FIGURE 1

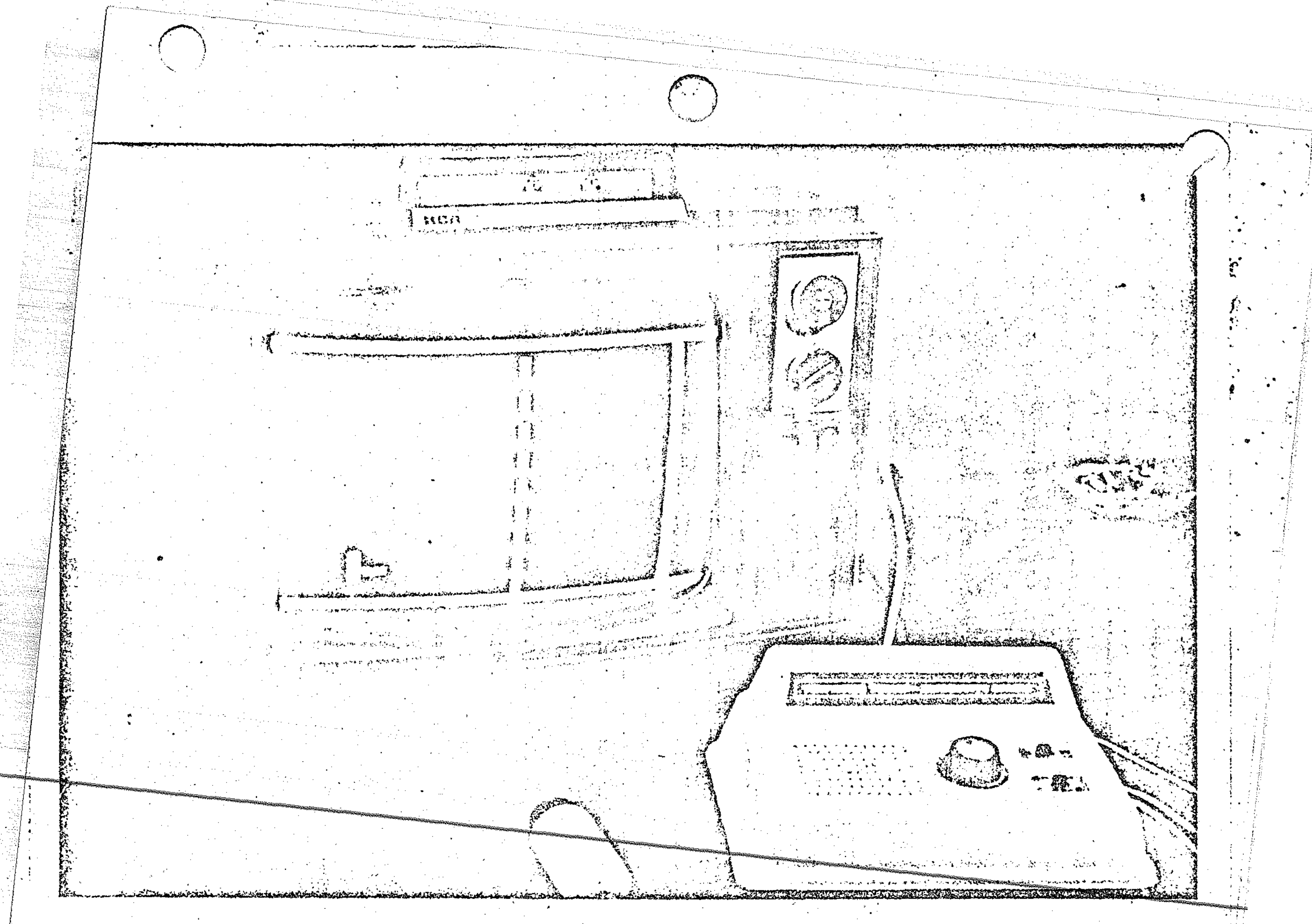
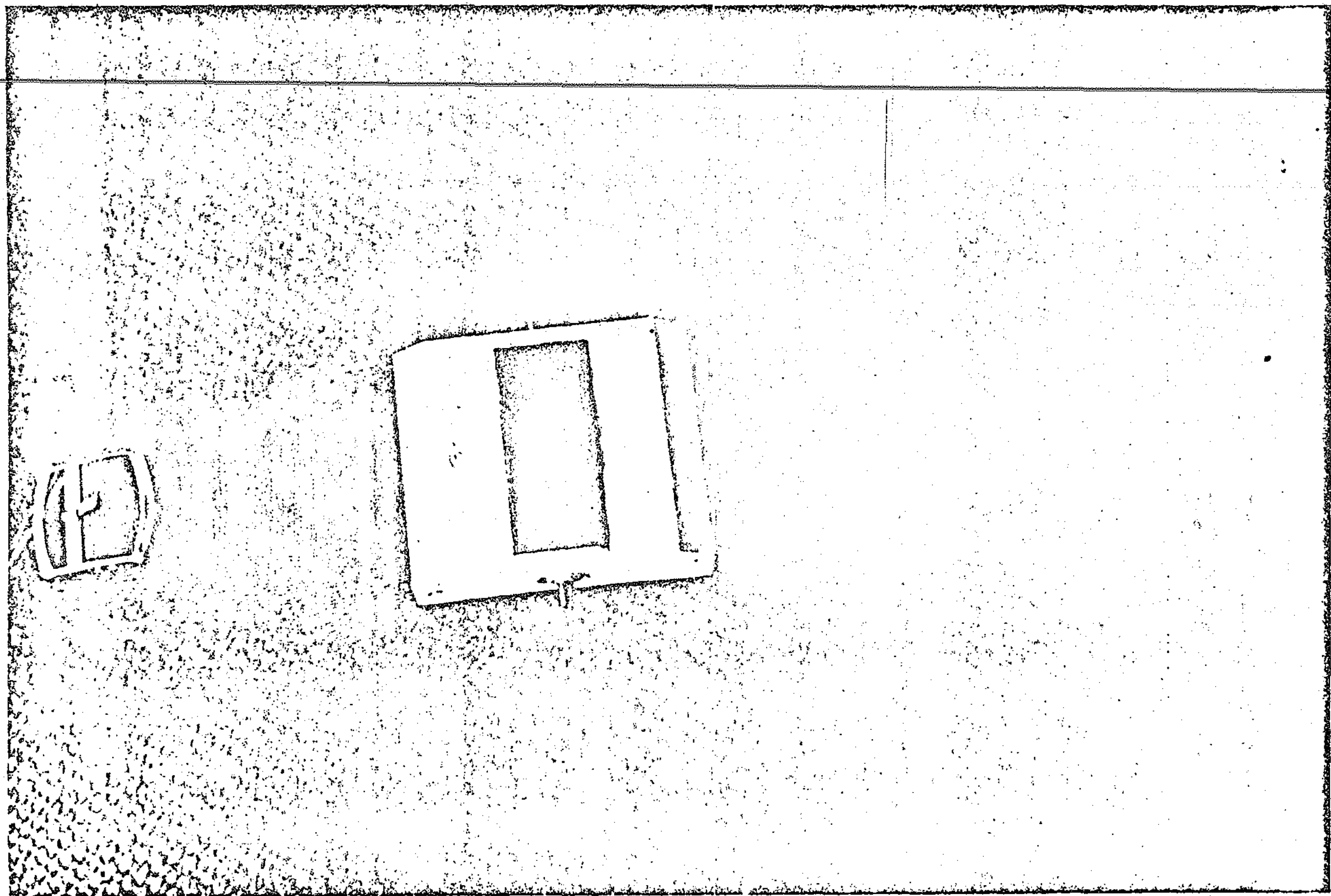


FIGURE 9



APPENDIX

CONCEPT COMPARISON BETWEEN UNITED STATES (US) AND WEST EUROPEAN (WE) UNIVERSITY-BASED INNOVATION CENTER ACTIVITIES

Summary

The US NSF Innovation Centers emphasize educational and experimental programs to assist potential entrepreneurs and innovators in achieving their career objectives. As such, the role of the university in stimulating technology innovation and university-industry alliances to accelerate the innovation process are of prime importance.

The comparable West European university-associated innovation activities emphasize research into the innovation process and the management of technological innovation; and management, technical, and product development assistance to existing businesses.

I. Summary of institutional resources to assist private industry:

Universities
- research
- technology
- management

Private institutions
- research
- technology
- management

Government laboratories/institutions

Government financial institutions
- loans
- investments
- subsidies

Private financial institutions
- loans
- investments
- grants

Public consultants

Private consultants

II. Summary of institutional services to assist private industry:

Education

Clinical experience

Training
- management
- technical

Assistance
- management
- technical

Loans

Investments

Grants/subsidies

Credits
- tax
- investment

Regulatory relief

Special compensation

III. US-NSF Innovation Center objectives:

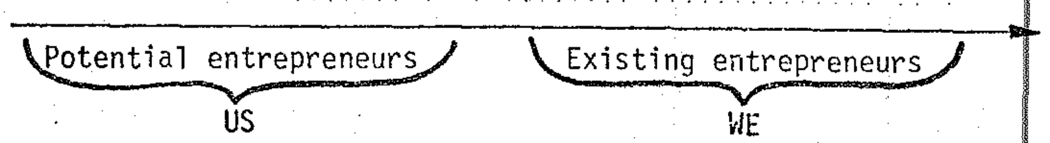
Research on innovation process/technological innovation
Management of technological innovation
Entrepreneurial career development
Idea/product development
Knowledge development

IV. Comparison of US/WE Innovation Center areas of emphasis:

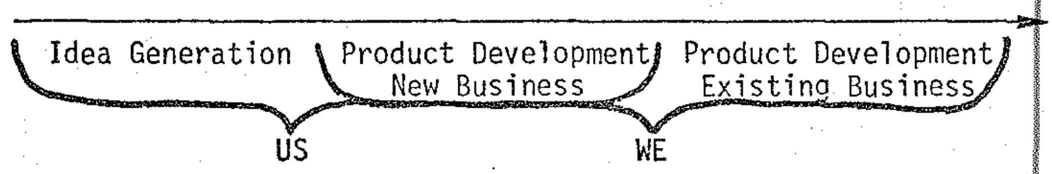
US	WE
▪Stimulating university/industry partnerships (self-sustaining), minimum gov't intervention, serving primarily as a catalyst.	▪Utilization of university resources to solve industry problems (continuous gov't funding), major gov't intervention.
▪Technology selected/developed by private sector (emphasis on technology in general).	▪Technology selected/developed by federal government (emphasis on specific technologies).
▪Education/assisting potential entrepreneurs/innovators.	▪Assisting existing businesses.
▪Affecting curricula and mainstream research/education interests of university in the direction of entrepreneurship/technological innovation.	▪Using university resources to assist business (consultation/product development), and researching the innovation process.
▪Career development	▪Product development

V. Innovation process descriptors and relation to US/WE Innovation Center activities:

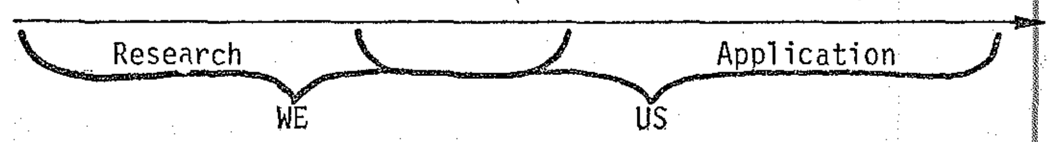
Career Development



Idea Development



Knowledge Development



VI. Innovation Center type institutions/locations & interests:

US

NSF Innovation Center locations & areas of interest:

- MIT - Research on innovation process/idea generation/new starts/ existing business product development (student entrepreneurs)
- CMU - New starts/process of initiating new starts (student entrepreneurs)
- ORE - Invention evaluation, business planning, and marketing assistance for independent inventors/small businesses (student evaluators)

WE

Great Britain; France; W. Germany; Netherlands; Denmark; Ireland: areas of interest:

- Training
  - technical
  - management
- Assistance
  - technical
  - management
- Financial
  - new venture initiation (not at WE univ.)
  - existing business product development

COMPARISON OF US/WE INNOVATION CENTER AREAS OF INTEREST

US	WE
• STIMULATING UNIVERSITY/INDUSTRY PARTNERSHIPS (SELF-SUSTAINING), MINIMUM GOVERNMENT INTERVENTION, SERVING PRIMARILY AS A CATALYST.	• UTILIZATION OF UNIVERSITY RESOURCES TO SOLVE INDUSTRY PROBLEMS (CONTINUOUS GOVERNMENT FUNDING), MAJOR GOVERNMENT INTERVENTION.
• TECHNOLOGY SELECTED/DEVELOPED BY PRIVATE SECTOR (EMPHASIS ON TECHNOLOGY IN GENERAL).	• TECHNOLOGY SELECTED/DEVELOPED BY FEDERAL GOVERNMENT (EMPHASIS ON SPECIFIC TECHNOLOGIES.
• EDUCATION/ASSISTING POTENTIAL ENTREPRENEURS/INNOVATORS.	• ASSISTING EXISTING BUSINESSES.
• AFFECTING CURRICULA AND MAINSTREAM RESEARCH/EDUCATION INTERESTS OF UNIVERSITY IN THE DIRECTION OF ENTREPRENEURSHIP/TECHNOLOGICAL INNOVATION.	• USING UNIVERSITY RESOURCES TO ASSIST BUSINESS (CONSULTATION/PRODUCT DEVELOPMENT), AND RESEARCHING THE INNOVATION PROCESS.
• CAREER DEVELOPMENT.	• PRODUCT DEVELOPMENT.

INNOVATION PROCESS DESCRIPTORS AND RELATION TO US/WE INNOVATION CENTER ACTIVITIES