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ECONOMIC IMPACT OF M.I.T. ON  
CAMBRIDGE AND METROPOLITAN BOSTON

by

IRVING WILLIAM FINBERG

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Signature of Author.....  
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Certified by.....  
Thesis Supervisor

Accepted by.....  
Chairman, Departmental Committee on Graduate Students

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ABSTRACT

Economic Impact of M.I.T. on Cambridge  
and  
Metropolitan Boston

Irving William Finberg

Submitted to the Department of City and Regional Planning on  
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degree of Master of City Planning.

This thesis investigated the economic impact of the Massachusetts Institute of Technology on its host city, Cambridge, and upon the Boston Metropolitan Area. The primary purpose was to develop sufficient information about the operation of a large educational institution to enable a city planner to study or forecast the direct and indirect impacts of a school on its locality and to measure the impact.

There was a corollary purpose to the thesis. It was to examine the pattern of M.I.T.'s primary economic impact within the Metropolitan Area.

The thesis analyzed all municipal costs and revenues to determine whether or not the institution was a financial asset to the city. It also investigated many, and hopefully all, other tangible and intangible benefits to determine the net benefit to Cambridge and the Boston Standard Metropolitan Statistical Area which was used as the area of study.

The result of the investigation proved that M.I.T. benefitted the City of Cambridge financially as well as by intangibles. The research verified the assumption that the direct and indirect impacts are felt primarily in the communities closest to the Institute. The primary impact was the result of employment and expenditures. The secondary benefits to the area resulted from the large flow of money from outside and by the multiplier effects of both M.I.T. and its family's expenditures. The examination of the pattern of impact disclosed that the student impact was greatest in Cambridge and nearby Boston. However, that of the staff and faculty and other employees was spread through the area but essentially in Cambridge and the suburban ring.

Thesis Supervisor: John T. Howard

Title: Professor of City Planning, Head of the Department

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## PREFACE

### GENERAL:

People are interested in schools and universities for many reasons. Some are interested only in the cultural and educational benefits to be gained through attendance. Others are concerned with the "common weal", the cultural and economic advantages which such institutions bring to their local communities. Still others are concerned only with the direct impact of the tax exemption which the educational properties enjoy, believing that the exemption adversely affects the tax rate on the remaining property in the community. There are others who have varied specialized interests in one or more phases of educational institutions. City planners, as a group, are interested in understanding how educational institutions function within their areas as part of the broader problems of city planning. The knowledge of how an educational institution functions is a means of gaining better insight into city operations and thereby evolving better solutions to the more complex problems of the city or area.

Many statements have been made by public figures concerning the benefits schools and colleges bring to their communities. There is almost universal agreement that these institutions are important adjuncts of city life, contributing materially to the economic well being of their communities. But there has been very little uncovered by this author which provided any significant detail of schools' operations which would enable a city planner, or any city administrator, to study or forecast the direct and indirect impacts of a school on its locality.

This thesis was undertaken to develop such information for one large urban school, M.I.T. It is a case study of that institution. It investigates the major aspects of the school's operations and tries to measure the

direct and indirect impacts on its host city, Cambridge and the component portions of its local metropolitan area, the Boston Metropolitan Area. Hopefully it adds to the growing store of knowledge of how cities operate thereby helping to provide a better basis for improving urban conditions in the future.

SOURCES OF INFORMATION:

In addition to data obtained through normal library research I have utilized and relied heavily upon the following sources-

- 1) M.I.T. publications such as the President's Report, The Treasurer's Report, Directories, Calendar of Events, etc.
- 2) M.I.T. internal reports and records particularly the Comptroller's Reports of FY 1963.
- 3) Interviews with Cambridge City Officials.
- 4) Questionnaires sent to approximately 10% of the M.I.T. family (Students, Staff, Faculty and Employees) regarding their spending habits.

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It is impractical to list the many people who have helped me in this thesis for the list would be very lengthy indeed.

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Thanks are due literally to hundreds of others at all levels in many offices at M.I.T. and elsewhere. My failure to mention them is due only to the length of the list. All gave willingly and warmly of their time. This thesis could not have been completed without that aid.

Irving W. Finberg  
Col. USArmy Ret.

## INTRODUCTION

"Knowledge consists in understanding the evidence that establishes the fact, not in the belief that it is a fact". (1)

There is widespread belief, supported by many statements made by public figures, that large educational institutions are of great economic as well as cultural benefit to the country, their states, and their local areas. Some typical statements are listed in Appendix I. Extensive research and correspondence with approximately fifty universities on the matter, uncovered a great amount of material on the general impact of universities in their areas. Only four articles were reasonably complete case studies of economic impact. (2) The major portion of the material was in general terms often written for specialized audiences. The material showed conclusively that universities are big business and of great importance to their areas. Very few of the articles gave sufficient detail to permit any measurement of the degree of the impact or to allow a comparison with other institutions and thereby produce a theory usable in city planning. ✓

A partial list of the studies uncovered by the research is given in Appendix II, Annotated List of Economic Impact Studies. They serve to establish that there is no widely accepted way to define or measure Economic Impact except in dollars, jobs, and percent of business which the institution generates.

This thesis is a case study of the economic impact of a large, urban education institution, the Massachusetts Institute of Technology, upon its

(1) Shipley, Maynard. Quoted on the cover of Industry as a Local Tax Base by Bureau of Business and Economic Research, University of Maryland, College Park, Maryland, 1960.

(2) a University of California, Berkely, California  
b Rutgers University, New Brunswick, New Jersey  
c University of Bridgeport, Bridgeport, Conn.  
d New England Colleges in General, on all of New England  
See Bibliography items 23, 9,32,19, for exact titles.

host city, Cambridge. It also covers the impact upon the surrounding communities of the Boston Metropolitan Area in which it is located. This study will establish whether or not M.I.T. is of economic benefit to its area. Hopefully it will act as a prototype for other similar studies which eventually will result in a theory of institutional impact usable by city and economic planners in the future.

Economic Impact is defined as the direct and indirect effects associated with an autonomous change in the local or regional economy. The direct expenditures by M.I.T. for salaries, taxes, service fees, and purchases in the community involved in the study, the direct costs of the host city to service the Institute, and the indirect impact of expenditures by the M.I.T. family in the area are all included. This definition is used as being the most workable. It is supported by a well known economist, W. E. Hirsch, who states that the focus on autonomous change as the initial stimulus is more common than other means when working in the field of Economic Impact. (3)

The direct effects are the jobs, their associated payrolls and the expenditures made directly by the Institute. The indirect effects are the expenditures made by the M.I.T. family and the multiplication effects by them and by M.I.T.'s business. Both direct and indirect effects are measured in dollars where possible. When dollars are inappropriate, then numbers and/or percent of people supported by M.I.T. or percent of business attributed to M.I.T. are used as the yardstick.

There are two basic hypotheses of this thesis. The first is that large, urban, educational institutions (such as M.I.T.) are valuable assets of

(3) Hochwald, W. H., ed. Design of Regional Accounts, John Hopkins Press, 1961, p. 23.

local and metropolitan areas. The second is that such institutions do not add to the tax burden of their local areas. Both hypotheses are validated by the data on M.I.T. (2)

A secondary purpose is to examine the pattern of M.I.T.'s primary economic impact within the metropolitan area. Here the hypotheses state that:

1. The major direct impact of students is felt in a limited area close to the Institution.
2. The direct impact of the non-professional staff is felt mainly in the communities which permit easy use of mass transportation to M.I.T.
3. The direct impact of the professional staff and faculty follows a different pattern than non-professionals, falling mainly within the core and the inner suburbs.
4. The direct impact of small purchases (under \$5,000) is felt primarily in the core of the metropolitan area.
5. The direct impact of the large purchases (over \$5,000) follows a markedly different pattern than does small purchases. In general large purchases are made from specialized suppliers without regard to location.

These were generally confirmed by the data on M.I.T.

The reader is reminded that this thesis merely explored the functioning of M.I.T. in its area in order to analyze factual relationships. There was no intention to explore or comment upon the operating or planning policies of M.I.T., or of the communities involved.

The reader is also reminded that this thesis considers only the Cambridge complex of M.I.T. The Cambridge complex consists of the main Educational plant and all of its associated laboratories. These include the National Magnet Laboratory, the M.I.T. portion of the Cambridge Accelerator, the Instrumentation Laboratory, the Nuclear Reactor, and the many other laboratories which are located in Cambridge. It also includes the Division of Sponsored Research EXCEPT for its Lincoln Laboratory which is located in Bedford, Massachusetts.

## BACKGROUND

### THE SITUATION IN CAMBRIDGE IN 1910-1916

The rapid growth of M.I.T. in its early years caused it to overflow into a conglomeration of purchased and rented spaces around the location of its first building, the Rogers Building on Boylston Street in Boston's Back Bay. A continued expansion in the makeshift manner became intolerable to M.I.T. by 1910. New sites were sought for the relocation of the Institute. About one hundred places in various parts of the Boston Metropolitan Area were offered to and investigated by the Institute. A fifty acre tract east of Massachusetts Avenue, on the Cambridge side of the then practically vacant Charles River Embankment, was selected contingent upon Cambridge agreeing to close the projected but unbuilt streets in the site. Negotiations with the city of Cambridge, owners of the vacant land, were successfully concluded. The City Council confirmed the street closures and other terms on December 26, 1911. Truly a momentous Christmas present for M.I.T. !

M.I.T.'s movement from Boston to Cambridge soon became a fact. Shortly after the confirmation of terms by the City Council the site was purchased, construction started, and the initial move made to the new buildings in 1916. The movement was completed in 1929, if it can be considered completed for there are still some fraternities, a dormitory and warehouses in Boston and Brookline.

At that time Cambridge was a bustling city with a population approximately 10,000 larger than the 1960 population after adjusting the 1960 figures for the change in basis of enumerating college students. (See Appendix III, Data Section, Table 1.)

The land in Cambridge, particularly that portion lying south of an east-west line through Harvard Square, was almost entirely built upon or in use. Vacant space in East Cambridge, other than an odd lot here and there, existed only along the Charles River Embankment and in the vicinity of Fresh Pond. (See Appendix III, Figure 1, 1915 map of Cambridge showing status of land utilization and vacant space in the city.) The anticipated development of the land created on the Cambridge side by building of the Charles River Basin had not occurred. Although the Esplanade, (Memorial Drive) was ten years old and was a beautiful drive, very few structures of any kind existed on the land of the embankment. The area was dull, grey, lacked vegetation, contained many irregular heaps of tailings and was literally a wasteland.<sup>(4)</sup> Streets were laid out, were legally approved, but had not been constructed. Cambridge had paid a large portion of the cost of the construction of the Basin. However, the City had expected to recoup its cost by the development of both sides of Massachusetts Avenue with high-class residences. The development had not occurred, nor was it imminent despite the favorable location. The move of M.I.T. was expected to be "the means of the development of the entire section west of Massachusetts Avenue as a high-class residential area."<sup>(5)</sup>

The matter of cost to the city due to the tax exemption which M.I.T. would enjoy was broached as an objection to the move by some politicians. The argument had small weight on the City Council's decision for the

(4) M.I.T., A Century of Technology, A Reprint of the Special Supplement in Technique, 1961, The Yearbook of M.I.T.

(5) Technology Review, a Quote by Mayor Barry of Cambridge, Vol. XIII, No. 8, November 1911, p. 496.

matter had been studied and the majority of the city government was thoroughly convinced that the Institute would benefit Cambridge more than it would cost.<sup>(6)</sup> The coming move was hailed by the civic leaders of Cambridge as being a great boon for the city.

#### THE SITUATION IN BOSTON, 1910-1916

M.I.T. enjoyed a worldwide reputation long before the critical crowded conditions around its home in the Back Bay caused it to look for new quarters. The area in Back Bay was almost solidly developed. Land was scarce and expensive. M.I.T.'s expansion in its home area could come only at the expense of hampering or delaying the expansion of commercial and industrial activities nearby. Boston favored the move of M.I.T. because it would relieve pressure on real estate in the area. Furthermore Boston would continue to reap the benefits because of M.I.T.'S worldwide reputation and the proximity of its new home, without having to incur the loss of tax revenues. In addition Boston viewed the open site on the Cambridge side of the Charles as one to be developed aesthetically. M.I.T.'s move to that site would assure a beautiful view for the Boston residents of the Back Bay. Such a development would allow the Charles River Basin to approach the beauty of the Alster Basin in Hamburg, Germany and the Seine in Paris. There was no doubt that Boston favored the move to Cambridge.

(6) Technology Review, Vol. XIV, No. 1, January 1912, p 2.



## M.I.T. IN 1963.

When M.I.T. moved to Cambridge in 1916 it was a relatively poor school with a moderate size student body by today's standards. It more than tripled its enrollment by 1963 and increased its staff and faculty proportionally. The original 50 acres were increased to 123 and contain an Educational plant valued at \$60,000,000. Total assets approximated \$240,000,000. (See Appendix III, Table 2, for additional statistical data.) Not only had the school grown tremendously in size, but it also had diversified its activities greatly. The growing demands for materials and services caused it to spread its activities throughout the region while maintaining Boston and Cambridge as its main base. The improved highway network also permitted the Institute to draw its service people from wider areas and to allow its staff and faculty to move to the suburbs as did so many other Central City residents.

The Institute's physical design, its activities and its worldwide fame all serve as a magnet in attracting out of state and foreign students in large numbers, tourists, and industries. The Institute is one of the basic industries of the region and plays a significant role in the total economy as an employer and purchaser.

The Institute is, for all practical purposes, the equivalent of an urban university. It shares in common with many other urban universities a constellation of problems deriving from its central location in a metropolitan area. These problems include dealing with traffic, expansion, land use, urban renewal of its surrounding areas and public relations with its local political community due to its tax exemptions. Metropolitan

institutions, of which M.I.T. is typical, also share in a common phenomenon by which their benefits are spread over a wide area without regard to political boundaries whereas their costs are generally confined to a single local political community.

This thesis confirms that M.I.T. is of great economic benefit to Cambridge and the Boston area and that it does not add to the tax burden of its host city, Cambridge.

#### THE BOSTON METROPOLITAN AREA

The Boston Metropolitan Area consists of a number of communities which are linked physically, economically and culturally with each other and with the City of Boston. The physical bonds are both natural and man made. The former includes the Charles River and the Boston Harbor, while the latter type consists of the Metropolitan District Commission's service facilities (water, sewage, recreation, parkways), the Metropolitan Transit Authority's Transportation lines and the general highway systems. The cultural links are the large metropolitan institutions such as the area's museums, regional parks, newspapers, theaters, symphony and educational institutions. The economic links include the downtown businesses, the regional shopping centers and the many interdependent industries. Because of such linkages the area is naturally defined differently by various researchers and statisticians, depending on the purposes of the studies. The term Boston Metropolitan Area is often used synonymously for the Greater Boston Area.

The United States Census Bureau defines a metropolitan area as the unified region related to a central city. The Boston Metropolitan Area,

under this definition, is not an exact area, but is as aforementioned, defined differently for different purposes. It is more or less a composite of the different areas mentioned above.

To simplify the matter and to allow a degree of standardization not otherwise attainable, this paper uses the Bureau of Census' definition and composition of the Boston Standard Metropolitan Statistical Area as its area of study. Figure 2 in Appendix III shows that composition. Table 3 in Appendix III lists the cities and towns which are on the 76 cities and towns of the Boston SMSA and gives a breakdown by Core, Inner Suburbs and Outer Suburbs. The division into these three categories was made in a more or less arbitrary manner based upon the author's interpretation of popular conception. The division was adjusted to be a compromise between the Boston Chamber of Commerce's compilation of 83 cities and towns of its Metropolitan Area and the Greater Boston Economic Study Committee's study region of 138 cities and towns.

The benefit of using the SMSA as defined by the United States Census is that there is a multitude of published data arranged by the SMSA and by component portions. This permits other possible uses of the document to make various compilations and comparisons which might not be possible if another non-standard combination was used.

#### TAX EXEMPTION

A common belief exists that educational and religious institutions are exempt from taxes by provisions of our Federal Constitution. This is not true. Only Article I of the Bill of Rights refers indirectly to a tax exemption by stating "Congress shall make no law respecting an establishment

of religion, or prohibiting the free exercise thereof,---". Through the years, by custom, we have used this clause to permit Federal tax exemption of all religious properties. Public policy has extended this to all non-profit institutions.

The power of the states to tax is derived from their own constitutions subject to the provisions conforming to those of the Federal constitutions. This means that all taxation must be uniform, proportionate and reasonable. Most states have constitutional provisions emphasizing these statements. Many contain clauses exempting educational, religious and other non-profit institutions from local taxation. The Massachusetts Constitution does not contain such provisions except for Harvard University. However, Chapter 59, Section 5 of the Commonwealth's statutes exempts from local taxation the property of various organizations including those of "charitable organizations". This law states that the "term shall mean (1) a literary, benevolent, charitable or scientific institution---".

M.I.T. enjoys its tax exemption privilege under this statute. The inherent protection of Massachusetts constitution emphasizes this privilege for it charges the Legislature "to cherish the interest of literature and the sciences-- and to encourage private societies and public institutions--- for the promotion of agriculture, arts, sciences, commerce, ---."(7)

Tax exemption problems occur because neither the Massachusetts Constitution nor its statutes are specific as to which type property is exempt. The question has never been ruled upon by the Massachusetts Courts as to whether the term "literary purposes" which the Constitution and statutes use, include

(7) Chapter V, Sections I and II, Articles 88, 89, 90, 91.

such adjuncts as dormitories, stadiums, student unions and other similar properties. There are many who claim that only the properties used directly for educational purposes are exempt. In fact, Mayor Collins of Boston introduced permissive state legislation in December 1963, which, if it had become law, would have allowed the communities of Massachusetts to tax existing dormitories and to tax all new property acquisitions of non-profit installations. This appears to be constitutional under Article VIII, The Objects of Government Rights of the People to Institute Change. This article permits the Legislature to "reform, alter or totally change" laws and even the constitution if done in accordance with constitutional procedures.

M.I.T. and Harvard have partially solved this problem with the City of Cambridge by agreeing to pay, during a limited term, funds "in lieu of taxes" for all new properties acquired after a certain date and to continue to make such payments on each property for a twenty year period. M.I.T.'s agreement provides that the Institute will make a "payment in lieu of taxes" for twenty years after the acquisition date on all land acquired during the period of the agreement. The sum to be paid annually is to equal the current tax rate for each year of the twenty year period but at the assessed value of the time of acquisition. The payments on the buildings, if any on the land, are covered by specific terms proposed by the Institute for each building involved. The basis is to permit adjustments to be made in assessments, operating expenses, etc. without causing financial havoc to the city due to sudden loss of tax revenue. This agreement was instituted in 1928 and was renewed in 1948

COSTS - BENEFITS

GENERAL:

It is a complex problem to determine whether an institution, such as M.I.T., is of benefit to its community and to measure the degree. The complexity is primarily due to the fact that both costs and benefits are end products of value judgements which differ widely between individuals. Another reason for the complication is that there is no standard definition of either costs or benefits. City fathers generally are primarily concerned with direct costs and direct revenues. These include the relatively easily measurable costs of municipal services and the tax revenues applied against particular properties. These direct measurable costs are generally the primary interests of city administrators.

Such officials usually conclude that a property is "good" when analysis shows that it produces greater revenues than costs. The indirect benefits of jobs and business created may or may not be considered in arriving at the final conclusion.

Individuals react differently than city administrators. Individuals often place high values on such intangibles as aesthetics, quietude, conveniences, etc. The indirect benefits such as creation of jobs and business are often considered as being more important than the direct costs and revenues. As a result the general public considers an institution "good" for its community even when the community's direct costs are greater than the direct revenues (taxes) for the property involved.

When M.I.T. was considering moving to Cambridge in 1911, many civic organizations were in favor of the proposed move despite the theoretical

tax loss.<sup>(8)</sup> The reaction of the public and the interest in the indirect benefits rather than concern about direct costs or loss of revenue was evidenced by the Cambridge Tax Payers Association statement "that it would be for the best interest to the City to have the Institute of Technology occupy this land---."<sup>(9)</sup>

The complexity of measuring the degree of benefit is also compounded by the lack of standard methods for making the analyses. The art, if it can be called that, of Cost Revenue Analysis is relatively new although such analyses had long been made for private projects. It was not widely used for public projects until 1936 when the U.S. Army Corps of Engineers started to make such analyses on a wide-spread basis for all water resource projects. Such action was dictated by the Federal Flood Control Act of 1936. That act required analysis to determine the benefits as well as costs and demanded that benefits exceed cost "to whomsoever they may accrue" for projects to be authorized.<sup>(10)</sup> Since 1936 the Army improved its system materially. Other government departments adopted similar methods and applied them to all types of public works projects. Nevertheless the system is still far from perfect. The major weakness lies in the pricing of intangible benefits.

(8) These included the Cambridge Board of Trade, The Cambridge Club, The Economy Club and the Tax Payers Association.

(9) Technology Review, Vol. XIII, No. 8, November 1911, p 494.

(10) Eckstein, Otto, Water Resource Development, Harvard University Press, Cambridge, 1958.

Mr. Eckstein's study of cost-benefits of water resource projects reached the following conclusions.

Having surveyed the benefit-cost procedures in four major fields of water-resource development, we can come to certain general conclusions about the present and the potential usefulness of the technique. Ideally, benefit-cost analysis would permit us (1) to rank projects in the same field, (2) to compare projects in different fields, and (3) to determine the proper expenditure levels for each of the federal programs. In fact, present procedures fall considerably short of these objectives, and while perfection in decision making involving projects that have economic lives of more than half a century is impossible, conceptual inconsistencies in current practice keep the contribution of benefit-cost analysis far short of what it might be. A benefit-cost ratio of 1.0 does not mean that a project will actually produce more benefit than its cost even if the forecasts of prices prove to be correct, and hence the analysis is not yet a proper means for determining how much money should be spent on the various programs. Nor is it possible to assume that projects in different fields with equal benefit-cost ratios have the same economic merit, this restricting the technique primarily to the comparison of projects in the same field. Yet benefit-cost analysis is an extremely promising evaluation method for public expenditures, which, in the limited cases where it can be applied, could put policy judgements on a much firmer economic basis than is usually possible. (11)

Other writers have added to the literature in the last five years. Nevertheless the city planning profession has not yet developed a method for identifying and comparing costs and benefits. Lichfield proposed a plan for general use in welfare planning in a 1960 article.<sup>(12)</sup> His summation stated:

"The analysis recommended would result in a set of social accounts forecasting the implications of a project for different interests in a community. The accounts would distinguish between producers' and consumers' costs and benefits. They would include direct and indirect costs and benefits, both measurable (in money or other terms) and

(11) Ibid p. 273.

(12) Lichfield, Nathaniel, "Cost-Benefit Analysis in City Planning, A.I.P. Journal, Vol. XXVI, No. 4, November 1960, pp 273-8



nonmeasurable. Measurable costs and benefits would be presented in either capital or annual terms. Both real and transfer costs and benefits would be included. Items would be arranged in double entry, costs to some accounts appearing as benefits to others. The resultant picture might well be complex...."

Lichfield also proposed a system for cost-benefit analysis for urban redevelopment<sup>(13)</sup> which is excellent for that specific purpose. Other writers, particularly Achoff<sup>(14)</sup> and Levin<sup>(15)</sup> have proposals which hold great promise. None were adopted as being suitable for this study although parts of all are usable.

#### MUNICIPAL COSTS-BENEFITS:

As previously implied the evaluation of costs and benefits in each field offers its own set of difficulties. The various studies mentioned above were discarded by this writer for use in determining the economic impact of M.I.T. on its communities.

A desire to measure costs and benefits in a simple manner dictated a review of Municipal Cost-Revenue literature. Fortunately one comprehensive review of the subject was recently written by Mrs. Ruth L. Mace of the Institute of Government of the University of North Carolina<sup>(16)</sup>. Mrs. Mace points out in her comprehensive study that municipalities provide a wide range of facilities and services with considerable disparity between cities, states and regions in the kinds and levels (quality and quantity) and in

(13) Lichfield, Nathaniel, "Cost-Benefit Analysis in Urban Redevelopment", University of California, Berkely, 1962.

(14) Ackoff, Russell, Towards Quantitative Evaluation of Urban Services. Resources for the Future, Baltimore, Maryland 1962.

(15) Levin, Charles L., "Theory and Method of Income and Product Accounts for Metropolitan Areas", University of Pittsburgh, Pittsburgh, Pa. 1963.

(16) Mace, Ruth L., "Municipal Cost-Revenue Research in the United States", University of North Carolina, Chapel Hill, N.C., 1961.

the manner of payment. She emphasizes that it is important to differentiate broad categories of services provided by cities for purposes of relating municipal costs to the land areas served. These categories are "Services to Property" and "Services to People" or "Services of Community-wide Benefits". The former includes those functions and facilities that can be specifically identified with the use of the land; the latter category includes those activities of a community-wide or general benefit nature essential whenever people live together in an urban setting.

The services to M.I.T. which may result in costs to the City of Cambridge fall naturally into these two categories. However, as Mrs. Mace also states, a further general breakdown is useful in trying to analyze costs. These are the costs of capital facilities which are expected to remain in use for reasonably long periods of time, and the annual operating costs involved in the maintenance and operation of capital facilities. These two subdivisions are equally applicable for "Services to Property" and "Services to People". This thesis uses all of these categories in its analysis of the costs and benefits of M.I.T. to the City and Metropolitan area.

## COSTS

Costs are the value of goods and services used to produce and operate or support a project or property. As indicated heretofore, city administrators are primarily interested in direct costs. City planners are generally concerned with the total or comprehensive costs. These include the economic and non-economic costs and the tangibles as well as the intangibles although they are not all measurable.

Typical costs which can be considered in a cost-benefit analysis are listed below in the arrangement suggested by Mrs. Mace. Note that many items appear in both columns. Observe also that most of the items (in both columns) incur capital costs as well as operating costs. Normally those which are asterisked (\*) are particularly expensive to build and are high in capital costs.

Services to Property	Services to People or Community-wide Benefits
Utility supply (water, sewage, gas, electricity telephone, fire alarm)	Recreation and Culture
Fire protection	Street Cleaning
Police protection	Welfare
Inspections (building, health, safety, etc.)	Aesthetic measures (planting and care)
Refuse collection	Traffic control
Snow clearance	City Planning
Access	Zoning
	*Education
	*Mass transportation
	General City Administration (Licensing, permits, public-relations)
	Cemetaries
	Refuse disposal
	Fire protection
	Police protection
	Inspections (All types)
	*Utility plants and systems
	*General street system
	Pollution control
	Tax exemptions

The measurement of the costs presents a difficult problem. Three basic approaches can be employed in arriving at municipal costs.<sup>(17)</sup>

A. The allocation of total costs of a function among the areas or users. According to Mrs. Mace's study this approach was the first used in early slum cost-analysis. The allocations are based on the assumption that the costs of these services will vary according to one or more factors, such as property valuation, size and number of structures and properties, type of structures and numbers of people. Assessed valuation is most frequently used in this method. Total cost of a department divided by annual operating costs results in the assumed cost for the service.

B. The use of performance budgeting techniques to attempt actual cost measurement. This system requires establishment of "norms" of size of area, size of crews, frequency of coverage, average units of time to obtain the services, etc. Such units are then applied to the "new" property and additional operating costs assessed according to the results.

C. The allocation of costs by experience. Department heads establish (and update from time to time) a table of percentage allocation of costs against land use. These tables are based upon the department head's judgement and represent an experienced allocation, but one which may also be biased and/or inaccurate.

None of the systems are completely satisfactory. It is possible to obtain widely differing results for the same service. Mrs. Mace's study showed that the following estimates of costs for police protection for a hypothetical residential subdivision in the town of Greenwood, North

(17) Mace, Op cit p 18.

Carolina.<sup>(18)</sup>

Method A. (Operating costs based on assessed valuation)	\$19,000
Method B. (Performance budgeting)	7,000
Method C. (Department head's judgment)	22,400

The figures speak eloquently for the need of further research into methods to be used.

Several such studies were made about the cost of municipal services to property. Isard and Coughlin's classic study of municipal costs and revenues resulting from community growth established that growth was not always beneficial to a community. Often the additional costs to service the new growth exceeded the resulting revenue from the growth.<sup>(19)</sup>

Heckler, in his thesis on the Impact of Offices on Rye, New York also discusses some of the problems that Mrs. Mace's study disclosed.<sup>(20)</sup> In his discussion of costs, he also uses the example of the allocation of marginal costs. His illustration is used to discuss the use of marginal capacities which do not require additional personnel or equipment; e.g. a school has classroom space and appropriate space for 25 children per class but has only 20 per class. Does it actually cost the city to keep this capacity unused until the time additional space is required? How much should be charged to the "new" property which furnished the few extra pupils? Obviously it is not a zero cost for the extra capacity was probably built for

(18) Ibid, p. 20.

(19) Isard, Walter and Coughlin, Robert E., "Study of Municipal Costs and Revenues Resulting from Community Growth", Chandler Davis Co., Wellesley, Mass. 1957.

(20) Heckler, Herbert M., "The Impact of Offices on Rye, New York", Masters Thesis in City Planning, M.I.T. 1964.

future needs and there is, at least, the capital costs of such extra space. Would the answer be different if the school's capital cost had long been amortized or the required capacity resulted from a declining population. These questions cannot be answered easily or well.

BENEFITS

The literature on Cost-Benefit analysis is in agreement on one point, that "costs are the value of goods and services used to produce and operate a project, and benefits are the values of the services provided."<sup>(21)</sup>

This definition serves well for the direct benefits, but it ignores the matter of the measurement of indirect and intangible benefits. In the final analysis a benefit is the end product of one's values. What may be considered a benefit by one may represent the opposite to another. For example, a merchant may depend upon, benefit from street traffic, which is highly objectionable to the residents of the same street. As important as is the definition, more important is the matter of weighing both costs and benefits to reach a rational conclusion. The following list was prepared to reflect together with the preceding list of costs, those items to be considered in undertaking the analysis of M.I.T.'s impact. The items, if positively valued, can reasonably be considered as a general benefit to a community.

It would be most unusual for the general public to consider any of the listed items in a negative manner but there is a strong possibility that particular people would do so. For example, some may consider the results of tourism enough of a nuisance to prefer the peace and quiet of the locale without strangers and to forego the "benefits" tourism might represent to the community.

An examination of the Table of Benefits, by categories, discloses pecuniary benefits as well as those that must be measured in other terms.

(21) Lichfield, op cit,. p 276.

In most cases (except the few in the Immeasurable Column) a practicable unit of measurement exists or can be formulated. That unit might be Time Saved, Hours of Enjoyment, Opportunities made Available, etc. Even in the tangible cases, descriptive terms will permit qualitative comparison of the feature and thereby permit a rational value to be assigned.

#### MEASURING M.I.T.'S IMPACT

The complexity of the systems reviewed, the arbitrariness of their definitions, their failure to consider intangibles and immeasurables, all sum up to the fact that the existing systems are not suitable for use in measuring the impact of a large, urban university. Therefore, this writer decided to design a new system for use in this project, fashioning it along the suggestions of Lichfield. The system is simple. Each cost and benefit item under consideration is rated as Plus (+) or Minus (-) after an evaluation of the factors involved for that item. The results are posted to a master sheet, (Table 4, Appendix III). Negative costs are considered positive benefits and vice versa. No attempt is made to weigh one item differently than another. After complete posting, the list is reviewed. Costs are reexamined to see if there are sufficient benefits to offset them - a matter of mental weighing and evaluation. If the final result shows a sufficient number of pluses in the benefit column, a number greater than the pluses in the cost column, the result is beneficial.

The matter of measurement of the degree is so complex that this writer decided that simple comparative qualitative terms would have to suffice, particularly as there would be the standard, measurable facts of employment, payrolls and expenditures to support the final conclusion.



TYPICAL BENEFITS

ITEM	DIRECT	INDIRECT	MEASUR- ABLE(1)	IMMEASUR- ABLE(2)	RECIPIENT	
					GAMB- RIDGE	BOSTON AREA (IN GENERAL)
Employment, direct	x		x		x	x
Employment, indirect		x		x	x	x
Magnet effect on						
Industry		x		x	x	x
Business		x		x	x	x
Population	x		x		x	x
Tourism		x		x	x	x
Expenditures by						
Institution on						
Materials	x		x		x	x
Services	x		x		x	x
Construction	x		x		x	x
Expenditures by						
Employees		x	x		x	x
Students		x	x		x	x
Revenues produced						
Taxes, real estate	x		x		x	x
Taxes, other (sales, income)		x	x		x	x
Fees, permits, licenses	x		x		x	x
Recreation Activities	x	x	x		x	x
Cultural Activities	x	x	x		x	x
Use of Facilities for other purposes (science fairs, night schools)	x		x		x	x
Prestige to Area		x		x	x	x
Urban Renewal Credits	x		x		x	
Aesthetics	x	x		x	x	x
Reduction of Capital Costs	x		x		x	

(1) Measurements may be in any standard unit.

(2) Item is considered immeasurable if it cannot be estimated with reasonable accuracy.

M.I.T.'S COSTS AND BENEFITS TO CAMBRIDGE AND THE BOSTON SMSA

GENERAL:

As mentioned earlier, a large installation in a metropolitan area is unique in that most of the costs are borne by the host city while the benefits are felt over a wide area. Because of the phenomenon the effects on the SMSA will only be mentioned in the subsequent paragraphs and Table 4, Page 64 when there is a definite recognizable affect caused by M.I.T.'s presence.

I. TAXES, REAL ESTATE:

Initially the City of Cambridge did not lose any tax revenue by M.I.T.'s move for the site chosen was vacant, city-owned land. There is no way to determine how the area would have developed if it had not been used by M.I.T. Hence there is no way of knowing what today's tax bill might have been. Surely if the area had developed residentially, there would be tax exempt portions for schools, churches and other community facilities. Under any conditions public streets, which are high land users, would have removed a large percentage of the land from the tax rolls.

In 1963 M.I.T. owned 123 acres. At the same rate shown for the distribution of land in Cambridge by Table 5, Appendix III, Statistical Summary of Land Use in Cambridge, 1957, approximately 33% would be in streets and community facilities including churches. The net taxable acreage would theoretically not exceed 92 acres. Assuming that M.I.T.'s land was taxed at \$4,000 per acre, the average of that of the entire city<sup>(22)</sup> the 1963 tax bill on those 92 acres would be \$368,000. If the full figure

(22) Obtained by dividing the 1962 real estate levey of \$16,062,532 by the 4002 acres of Cambridge.

of 123 acres was used the bill would be \$492,000. M.I.T. paid \$215,680.08 "in lieu of taxes" in 1963. In addition it paid \$508,904.22 in regular real estate taxes or a total of \$742,584 for that year.<sup>(23)</sup> According to data furnished by the Cambridge City Assessor's Office, M.I.T. (Table 6, Appendix III) is Cambridge's largest taxpayer. Surely this proves that tax-revenue wise, even without the indirect benefits of higher taxes from the increased value of nearby properties due to M.I.T.'s presence, M.I.T. is a positive benefit to Cambridge.

(23) Data from office of M.I.T. Vice President for Operations and Personnel.

## II. LAND UTILIZATION:

Statements have occasionally appeared in the press that Cambridge's high taxes are caused by the fact that the educational institutions own so much tax exempt land. Since M.I.T. is making high "payment in lieu" of taxes on most of its land, the statement relative to M.I.T. is false.

Research disclosed that Cambridge does have a large percentage of its land in a tax exempt status<sup>(24)</sup>. However the 53.6% of Cambridge land which is in public and private, but tax exempt, status is not unusual for a city of its size. Bartholomew's study of land uses in American cities shows that land use in cities of 100,000 (size of Cambridge) is almost equally divided between the private purposes of residences, commerce, industry and all the public and semi-public purposes including streets, and recreation.<sup>(25)</sup> Bartholomew did not include schools and colleges as a separate category. Therefore, the study cannot be used to make a comparison of Cambridge's use of land for schools and colleges.

Cambridge has a relatively small percent of its land, 7.4% in use by private schools and colleges (excluding parochial schools).<sup>(24)</sup> Yet Cambridge has long been known as "The University City". The utilization of such a small percentage of land is a small price to pay for the jobs and secondary effects which the schools and colleges produce in the city.

The often stated claim that the schools are gobbling up all available land is also disproved by research. In 1957 schools and universities utilized 6.51% of the total land in Cambridge.<sup>(26)</sup> In 1963 the percentage

(24) Table 7, Appendix III.

(25) Bartholomew, Harland, "Land Use in American Cities", p. 70.

(26) Table 5, Appendix III.

had risen to 7.4%. Acreage in use was 260.59 and 299.6 for the respective years. Employment in this category in which schools are included had grown 39% or three times greater than the increase in land utilization.<sup>(27)</sup>

The ownership of the aforementioned 7.4% is elaborated upon in Table 8, Appendix III, Tax Exempt Property of Schools and Colleges, 1963. It shows that M.I.T. and Harvard (including Radcliffe) (the often named culprets of the "land grab") only own 6.5% of which M.I.T. owns only 2.7% or 111.5 acres. Again, a very small amount of land acreage-wise as well as percentage-wise.

The evaluation as to whether this type of land utilization is a benefit or not depends on other factors such as taxes, discussed above, and further discussion to follow. Therefore no evaluation is assigned this category.

(27) Committee for Cambridge, Citizens Advisory Committee Newsletter, "Report on Cambridge Employment", July 10, 1964.

### III. MUNICIPAL SERVICES

#### A. Utilities

Most utility systems, including the municipal and privately owned ones in Cambridge, price their services at rates to be self-sustaining or to make a profit. The rates cover both capital and operating charges. M.I.T. pays for all its utilities as does any other consumer. Utility costs therefore should not be considered as a cost to the city for any user unless the city has to expend a disproportionate amount of capital to extend the lines to the area, or to increase the capacity of main lines to support the incoming loads. As mentioned in the background section, the city was well developed before M.I.T. moved. Extension of lines to service the area was not required. Furthermore M.I.T. places a low load on the water and sewage systems. This reduces the possibility of requiring increased size of lines to support the area and is therefore considered a benefit.

There are several other benefits to the city's utility system because of M.I.T.'s presence. M.I.T. property is essentially in two large plots. The internal distribution lines were installed and are maintained by M.I.T. This materially reduces both capital and operating costs and definitely establishes M.I.T. as a benefit.

Further indirect benefits accrue to the system because M.I.T., as a large and consistently regular user (among the 10 largest users of gas and electricity) theoretically permits the suppliers to effect economy of scale in their operations. <sup>(27a)</sup> In the case of electricity, M.I.T. maintains its small generating plant (28000k.w.) which it no longer uses for itself as a standby plant for the Cambridge Electric Company. The nominal payments

(27a) Statements by companies concerned.

made by that company for this standby capacity is much less than the capital costs for similar capacity and theoretically reduces all electric bills in Cambridge. This financial gain and the increase in the overall reliability to the distribution system increases the benefits to Cambridge under this classification.

## B. Protective Services

### 1) Police

M.I.T. maintains its own campus police force. It thereby reduces the overall police requirements of the city. The type of occupancy, educational institutional and laboratories, permits the city to reduce the size of the force. Development in another manner would require more police services than does M.I.T. Furthermore M.I.T. has a policy of providing extra police service when required by special activities, at its own expense (by employing off-duty police). This policy also reduces the total requirements in the city's police force and permits it to be slightly smaller or to reduce overtime charges. Capital costs because of M.I.T.'s presence is negative or insignificant as the city maintains only one station, the central headquarters at Central Square. The cost of police service for Cambridge is less with M.I.T. than with any other type development. This conclusion was confirmed to this writer by M.I.T.'s Chief of Campus Police and Cambridge's Acting Police Chief.

### 2) Fire

The same fire stations that existed in East Cambridge before M.I.T. moved there with generally the same size forces are in use today. According to Cambridge's Fire Chief, the high standards of construction and the low

fire hazard on M.I.T.'s area (as low, if not lower, than any other possible development) permits the Cambridge Fire Department to furnish better city-wide service at no additional expense. M.I.T. is, as far as the Fire Department is concerned, clearly a benefit to the city.

C) Refuse Collection

M.I.T. provides its own refuse collection for its area eliminating municipal costs for this item. This policy permits the sanitation department to be somewhat smaller and/or to give better service to the rest of the city. Again M.I.T. scores a plus in the benefit column.

D) Inspections, Permits and Licenses

The largest number and the most costly inspections are those related to large alterations and new construction. Fees are set by the city to cover the costs to the building department from the initial submittal of plans to the final inspection upon completion of construction. The Superintendent of the Building Department considers that the fees generated by M.I.T.'s construction program (often at maximum) are sufficient to cover the costs chargeable to his department by M.I.T.'s construction activities. He also stated that there is a reasonable possibility that M.I.T.'s construction program produces a surplus for his department.

Other charges are made for permits (oil burners, demolitions, alterations, water connections, etc.), for inspections (annual elevator, assembly areas), and for licenses (special size oil storage tanks, etc.). These are all based on a self-sustaining basis or are insignificant in the total operation. The item is therefore not classified as either cost or benefit.



E) Street Servicing

This item includes repairs, cleaning, snow plowing, planting and care of trees, grass, etc.

There are very few streets that traverse M.I.T.'s area. The few that do cross are main streets which service other areas and organizations. The aforementioned services would have to be maintained regardless of who occupied M.I.T.'s site. Therefore they are not properly chargeable as an expense caused by M.I.T. Furthermore a major portion of the street servicing expense, that incurred by Memorial Drive, is not the City's but an MDC function. Thus far, street servicing is neither a cost nor a benefit. However, there is a benefit which accrues to the city because of M.I.T.'s presence. The large blocks of property under private ownership reduce the total amount of servicing that must be done at city expense. The item is therefore listed as costing the city less (a benefit) because of M.I.T.'s presence.

F) Education

The annual per pupil cost for public education in Cambridge approximates \$500. The major portion (\$460) must originate from local taxation.<sup>(28)</sup> Some people will argue that M.I.T. is an expense to Cambridge and causes Cambridge to bear the educational cost for each public school pupil who comes from an M.I.T. family. The family includes faculty, staff, students and employees. This writer unequivocally rejects such an argument. A public school system exists to provide for the children of the community regardless of the place of employment of the parent. Admittedly, the

(28) Commonwealth of Massachusetts, Annual Report, Department of Education, pp 10 and 11.

system could conceivably be larger if an institution or factory drew more people to the community. However Cambridge had a larger population before M.I.T. arrived on the scene.<sup>(29)</sup> True, the M.I.T. family lives in Cambridge because Housing is available there. If the available units were not occupied by personnel working or studying at M.I.T. they presumably would be occupied by people who worked elsewhere in the Metropolitan area.

A recent employment study of Cambridge shows that there is a net surplus of 32,000 jobs in Cambridge. (Total employment in Cambridge less total number of employed Cambridge residents).<sup>(30)</sup> It is reasonable to assume that if the dwelling units were available many would be filled by these 32,000 people and their families. Hence the cost to Cambridge for the educational system is correctly chargeable to the residential buildings and not to M.I.T.

However, the same argument holds true in Cambridge's favor when speaking of the children of the married students who live on campus. New quarters for married students were opened in 1963. Approximately 20 school age children live there.<sup>(31)</sup> It is reasonable to contend that Cambridge incurs an extra cost because of these children whose families may have moved to Cambridge because of the "on campus" quarters. Education is therefore considered to be a cost to Cambridge. It should not be offset with probable claims of another type development for to do so is too hypothetical and subject to too much conjecture.

(29) Table 1, Appendix III, Population of Cambridge.

(30) Committee on Cambridge, Newsletter, 1964.

(31) Data from Dean of Residence Office showed 96 children "on campus" of which only 17 were of school age. No data was available as to whether the children attended private or public schools.

G) Welfare

Welfare costs are a major portion of the city's budget. Specific data is not available to determine if there are any costs chargeable to M.I.T. for names of parties concerned are confidential. However, it is extremely unlikely that there are many, if any. If any, they would presumably be Cambridge residents working at M.I.T. and therefore the item would not be accepted in this thesis as a cost incurred by M.I.T.'s presence. Under the assumption that the cost is insignificant anyway, no evaluation is made for this item.

H) Recreation and Library

As in the foregoing item, specific data is not available to draw a rational conclusion. Because of the extensive athletic, recreational and library facilities immediately available to the M.I.T. family it is unlikely that many of the family use Cambridge's facilities. Again, if any costs occur they would presumably be insignificant so this item too is left without an evaluation.

I) General City Administration

This category includes all those municipal services not specifically covered above. Many are minor and can be ignored. An important service, City Planning is a definite cost to the city. M.I.T.'s size, complexity and constant expansion demands that Cambridge's Planning Board pay close attention to the Institute and its problems. However, the Institute offsets this cost by making accessible M.I.T. studies of Cambridge and by general assistance to the Planning Board. This overall item is also left without assignment of cost or benefit.

#### IV. CONTRIBUTIONS TO THE ECONOMIC BASE OF THE AREA

##### 1) The Flow of Money into the Area

A "basic" industry of an area is one which brings in money from the outside by the exporting of a locally manufactured article or a natural resource or by enticing outsiders to come in and spend their money in the area. The basic industry is a fundamental source of employment for the area or community.

Educational institutions, such as M.I.T., where the students come from outside the city, constitute one of the fundamental sources of employment and are "basic" industries.<sup>(32)</sup> The students are supported primarily with funds from outside the area. In addition gifts, grants, visitors, government and industrial research contracts, etc. all cause funds to flow into the area from outside. M.I.T.'s Treasurer's Report, analyzed with the knowledge of the origin of students, gifts, grants, etc. and major research contracts, indicates that the greater portion of the Institute's \$94,000,000<sup>(33)</sup> revenue flows into the Boston locale from outside. In addition to the flow of money directly to the Cambridge portion of the Institute, one should consider that this revenue is only a portion of the total that comes into the area because of M.I.T.'s presence. There are countless official and unofficial visitors whose disbursements are felt in the area. Then there is the money which the students bring in in addition to the sums paid for tuition and fees to the Institute. This is estimated

(32) Hoyt, Homer, "Economic Background of Cities", Journal of Land and Public Utility Economics, May 1961, p. 189.

(33) Treasurer's Report, FY 1963, Schedule B, p. 10.

conservatively at \$1,000 per student per year to total \$7,000,000. The total of "outside" funds which M.I.T. attracts into the area is considered to be at least \$100,000,000, another positive benefit of M.I.T.'s presence.

## 2.) Employment

M.I.T. is the seventh largest employer in the Boston SMSA and the second largest in Cambridge excluding government.<sup>(34)</sup> The total 1962 employment in Cambridge was 78,357<sup>(35)</sup> and is assumed to be substantially the same for 1963. This means that M.I.T. alone is the direct source of almost 10% of the jobs in Cambridge. As there is a net surplus of 32,000 jobs in Cambridge (total employment in Cambridge less total number of employed Cambridge residents)<sup>(36)</sup> employees must be drawn from the entire area. This is borne out by the distribution of the M.I.T. family shown in Table 12, Appendix III.

In addition to the 8,000 M.I.T. positions, the Institute's construction program fosters a direct increase in employment in Cambridge and the area. Table 14 shows that M.I.T. has approximately thirty major construction jobs in process each year at a cost of approximately \$22,000,000. This program is included in and contributes materially to the total number of jobs in Cambridge, already stated as more than 78,000. The construction program also adds to the total number of jobs in the area through employment subcontractors working on the M.I.T. projects and hence it is considered a benefit to Cambridge and the area.

(34) Table 9, Appendix III, Leading Employers in the Boston SMSA.

(35) Cambridge Newsletter, op. cit.

(36) Ibid.

### 3.) M.I.T. Purchases of Goods and Services

The Comptroller's Reports show that M.I.T. purchased some \$23,000,000 of goods and services in FY 1963. Ninety-three percent (93%) of this amount is purchased in the cities and towns of the Boston SMSA.<sup>(37)</sup> Boston and Cambridge received the lion's share with 57% and 19% respectively. The total activity represented 84,000 transactions of which only 600 purchase orders were larger than \$5,000.<sup>(38)</sup> The latter were dispatched throughout the United States to specialty firms or home offices of specific large companies many of whom subsequently furnished the supplies through local distributors.

The distribution of orders within the SMSA leaned preponderantly towards the cities and towns having large commercial and industrial complexes. These were generally located in the core and inner suburbs. The outer suburbs received little, if any, business. See Table 11, Appendix III.

In addition to the purchase of goods, M.I.T. is currently in the midst of a very large construction program, with some \$23,000,000 of construction projects under way. While a number of these projects have been awarded to firms whose home offices are outside the SMSA, many have gone to local contractors. In either event the major portion of the subcontractors are located within the SMSA and therefore a secondary round of purchases directly creditable to M.I.T. occurs. These purchases are not reflected in the M.I.T. figures above.

(37) Table 11, Appendix III, Distribution of M.I.T.'s Purchases.

(38) Table 10, Appendix III, Distribution of M.I.T.'s Purchase Orders.

The results of M.I.T.'s purchases and construction program are of positive value to the recipient towns and cities particularly to those receiving a large volume of business. Hence the item is a benefit to both Cambridge and the area.

V. URBAN RENEWAL CREDITS

Federal Urban Renewal regulations permit a city to claim certain expenditures other than its own as credits against the city's contribution to the costs of specific renewal projects. These credits include the expenditures by educational institutions to demolish, renovate and/or replace obsolete buildings within certain distances of the renewal projects.

The M.I.T. construction program results in \$5,000,000 of credits being available for use by Cambridge towards Cambridge Urban Renewal Projects.<sup>(39)</sup> Naturally it is only usable if Cambridge meets all the required conditions. A strong possibility exists that the credits are of great positive benefit now and in the immediate future. Cambridge is presently considering several renewal projects against which these credits may be applied, including one for NASA's new Electronic Center.

The degree of possible benefit is indicated by the following table of credits.

Cambridge Urban Renewal Credits (From M.I.T. Construction) (40)	
Amount	Expiration Date
\$2,500,000	Fall 1965
500,000	1967
2,000,000	1969

(39) Source - Cambridge Planning Board, Unpublished Data.

(40) Ibid



## VI. REDUCTION OF CAPITAL COSTS

As mentioned in the Utilities Section (Page 32) M.I.T.'s possession of large sections of land in undivided blocks permits the city to have a much less extensive street and utility distribution system than would otherwise be possible. This reduction represents only a minor amount in the overall costs of the city's capital system. However, the fact is mentioned because it is a direct benefit to the host city. It may be overlooked in studies of this nature. No attempt is made to measure the amount for all assumed solutions would be purely hypothetical.

## VII. INDIRECT BENEFITS

### 1.) The Magnet Affect on Industry

Appendix I lists a few typical remarks about the magnet affect of universities on industry. Both Mr. Danilov's and Mr. Webb's statements are particularly appropriate at this moment. Public announcement has just been made that the National Aeronautics and Space Administration's new Electronic Research Center will be located in the Kendall Square area of Cambridge. The site was chosen primarily because of its proximity to M.I.T. According to NASA's study, besides the jobs which the construction of the Center will provide, there will be \$5,000,000 annually expended directly by the Center. This will result in \$28,000,000 local income. There will be 2100 positions in the Center which will produce 3700 additional jobs in the area. (41)

(41) NASA, Electronic Research Center, Figure 1, Table 2, Part III, "Synopsis of Economic Impact" (an unnumbered Appendix of the Report).

M.I.T. is generally also credited for incubating and expanding the extensive electronic industry of the area. This process is continuing with every new development which M.I.T.'s laboratories produce. The results are felt throughout the SMSA but particularly in the town close to M.I.T. This impact of M.I.T. is immeasurable but there is no doubt that it exists particularly close to M.I.T.

## 2) Effects on Business and Employment

M.I.T.'s direct effects on business and employment are reflected by the amount of purchases in the area (Table 11, p.72 ) and the size and distribution of M.I.T.'s payrolls (Table 13, p. 77). The indirect effects are materially higher and conservatively estimated as being in the order of 2.0 on business and employment. This estimate is based on the aforementioned studies made for NASA's location of its Electronic Research Center. The factor is also an accepted one in Economic Base studies. Such studies normally state that "service" employment is at least equal to the "basic" employment. Hoyt, in his study of Evanston, Illinois, stated that Northwestern University's faculty of 472 and student body of 9,000 (as compared to 1,000 and 7,000 for M.I.T.) probably supports another 2,000 people in Evanston.<sup>(42)</sup> NASA's study states that the consumer multiplier for the nation is 2.0, the figure used above.<sup>(43)</sup>

(42) Hoyt, Homer, "The Economic Survey of Land Use of Evanston, Illinois, 1949", p. 18.

(43) NASA Report - Part III of Synopsis, op. cit.

M.I.T. pursues a policy of hiring students for many of the part-time jobs on campus. None of this employment eliminates any full time jobs but merely provides for peak periods as occur in the dining halls. This policy accomplishes two things of benefit to Cambridge and the immediate area. The on-campus employment eliminates competition for the local jobs by the many students who work locally during the school year to help support themselves. The employment also adds to the buying power of the student body and is reflected by a small but general increase in business through student expenditures. A report of the Office of Student Personnel shows the following:

M.I.T. Student Employment, FY 1963

Total Earned	\$1,382,000
Students Employed	2282
Permanent Positions Filled <sup>(44)</sup>	1709
On-Campus Jobs	2200
Off-Campus Jobs <sup>(45)</sup>	55
% of Jobs Filled by Undergraduates	90-95%

(44) A permanent position is one that is required for six weeks or longer.

(45) Does not include jobs obtained directly by a student with an employer.

3.) Expenditures by the M.I.T. Family.

Expenditures of the M.I.T. family were measured by means of questionnaires sent to approximately 10% of each category of persons, that is, Students, Staff and Faculty and Employees. (Pages 86-97 for the 3 questionnaires used). The results show: Undergraduate students spend an average of \$2500 per academic year in addition to tuition payments. Graduate students spend about 20% more than undergraduates, or about \$3000. At the lower average of \$2500, which is used as it is the more conservative, student expenditures approximate \$17,000,000. A substantial portion, estimated at \$3,000,000 is already accounted for in Institute revenues from dormitory and dining services and medical insurance payments.

The answers indicate that faculty expenditures are considerably higher than those of students and range from \$5100 - \$9000 for the academic year. As a result a minimum of \$5,000,000 circulates in the area. Only the lower figure of \$5100 is considered reliable as the responses were too few in number to permit consideration of many reported atypical one-time purchases.

Employees report an average expenditure of approximately \$4800 excluding purchases of automobiles and other major appliances. The same is not considered representative of all the employees as the range is even wider than that of the faculty, including janitors and clerical help through highly skilled technicians. Nevertheless the writer considers that a minimum of \$19,000,000 is expended by the employees.

Therefore the total secondary benefits are a minimum of \$38,000,000 additional business in the area due to M.I.T.'s presence.

No attempt was made to measure the location of the expenditures, except to divide total expenses between Cambridge and elsewhere in the Boston

SMSA. The results of the questionnaires show that the majority of recurring expenditures of students are made in Cambridge regardless of the students residence. However, this same situation did not hold true for faculty and employees. Their answers verify that very few of Cambridge's non-resident faculty and employees spend much of their money within the City.

The questionnaires also show that a great portion of recreational expenses, clothing and major appliances are made outside of Cambridge, presumably in downtown Boston or in the regional shopping centers.

#### 4.) Aesthetics

The Charles River Basin is one of the prime tourist attractions of the Boston area. M.I.T.'s presence with its stately buildings, open space and beautiful landscaping contributes immeasurably to the total picture. M.I.T. helped create and now maintains the strong favorable image of the basin and area.

The overall physical character and quality of the Hellenic complex of M.I.T.'s main educational plant, the distinctive designs of the Kresge Auditorium and Chapel, and of the other buildings, create an image of strength and beauty for the community. This image contributes greatly to offset the negative reaction caused by the surrounding crowded city.

The prediction which was made in 1916 has proven true. It was:

"...no location in Metropolitan Boston will remain more permanently effective for a public or semi-public institution than the borders of our new Charles River Basin." (46)

(46) Technology Review, Vol. XIII, p. 488, op. cit.

5.) Miscellaneous

It is impractical to name all the indirect benefits that accrue to an area due to the presence of a large educational Institution. Typical are those of M.I.T. in the ensuing categories:

Cultural M.I.T. hosted the following major events in the past year: 33 concerts, 27 general lectures, 29 movies, 12 plays, 13 organ recitals. In addition there were innumerable exhibits, special technical lectures, symposia and conferences held. Although all activities are primarily for the benefit of the staff and student body, all but a few are open to the general public, often at no charge. The Institute also supports the Educational T.V. Station in Boston.

Use of Facilities M.I.T. willingly extends the use of its facilities to the area for the general welfare of the population. For example, M.I.T. annually hosts a Science Fair for high school students, furnishes classroom space to the Massachusetts Division of Extension for general educational courses (evening courses) and operates Lowell Institute School (a technical night school). M.I.T. offers library service to many industrial and commercial organizations of the area through the Institute's Industrial Associates and Industrial Liaison programs.

Community Support M.I.T. actively supports a number of community programs of all types. Typical is the assistance given to such drives as United Fund (\$91,000 in 1963), Blood Drive (1325 pints in 1963) and the support of local boy scout units.

All the foregoing and many similar unmentioned items sum up as tremendous indirect benefits to both the host city and the SMSA.

## SUMMARY AND CONCLUSIONS

This thesis uses the Massachusetts Institute of Technology as a case study to show the economic impact of a large, urban educational institution upon its host city and the communities of the surrounding metropolitan area. It was also intended to measure, in some manner, the direction and extent of that impact.

The subject was chosen because research of the literature in the field failed to disclose any significant data on the affects of a large urban institution on its locale. A great deal of material, mostly in the form of speeches by university people, was uncovered in which economic impact of universities was discussed but only in very general terms, or by quoting payrolls and money spent by the school and its family. This material was almost universally unusable to produce any theory by which the vehicle, the Massachusetts Institute of Technology, or any other existing or proposed institution, could be examined and the specific impact measured. In addition most of the literature and the speeches failed to explore the costs that are incurred by a city to host a large institution.

The research also failed to disclose any acceptable methods by which the desired analysis could be made. All studies referred only to the direct benefits of jobs provided, dollars spent, payrolls made and to the indirect benefits caused by the expenditures of those people located at the university.

Several theoretical methods of making an analysis of the desired type were proposed in the literature. One by Nathaniel Lichfield, an English city planner and urban economist, was used as the basis for

determining the affects of M.I.T. on its area. Lichfield suggested that "proposals (of city plans) be tested for their likely effects on community welfare, to make what is here called a 'welfare test'".<sup>(47)</sup> He went on to explain how all implications in costs and benefits should be included regardless of whether they are tangible or intangible, and whether they are easily measurable or not.

This suggestion was taken. A table was prepared of all reasonably possible costs and benefits and the situation reviewed item by item. No attempt was made to weigh one item against another, only to decide if a cost or a benefit resulted and if so whether its impact was directed towards Cambridge or to the area or to both.

The thesis hypothesizes that-

1. M.I.T. is a valuable asset of the local and metropolitan area.
2. M.I.T. does not add to the tax burden of its local area.
3. The major economic impact occurs close to the Institute (in Cambridge and in Boston, the adjacent central city,) with different patterns for the Institute's direct purchases and for the indirect impact of the expenditures by the M.I.T. family.

The thesis supports the hypotheses. M.I.T. incurred practically no direct costs to Cambridge, only a few dollars for the education of the children who live "on Campus". The Institute makes payments "in lieu of taxes" on all of its tax exempt property which has been acquired within the past twenty years. The Institute also has a large amount of "investment" property in Cambridge on which it pays normal taxes. In fact it is by far

(47) Lichfield, Cost-Benefit Analysis in City Planning, op. cit. p. 275.



the largest taxpayer in the City.

Another myth which this thesis exploded is that the educational institutions are gobbling up the City's land. Investigation shows that the total amount of tax exempt land owned by the educational institutions in the City is 7.4% and has only increased 0.9% since 1957. M.I.T.'s total ownership is only 123 acres or 2.4% of total land in Cambridge for which M.I.T. paid \$215,680 "in lieu of taxes".

M.I.T. is the 7th largest employer in the area and the 2nd largest in Cambridge. There are 8,000 people on the payroll, a number which exceeds 10% of the total employment in Cambridge. M.I.T. is also directly responsible for an unmeasured number of the 78,000 workers in Cambridge due to a \$22,000,000 construction program.

M.I.T. is directly responsible for the flow of more than \$100,000,000 into the area through tuition payments, gifts, grants and research contracts and for the support of students by external funds.

An indirect impact is caused by the purchases of the M.I.T. family whose expenditures of approximately \$38,000,000 in the area. Cambridge is a major recipient of this benefit due to the large number of students, staff and faculty, and employees. Cambridge receives more than 20% of the SMSA payroll.

The research also discloses that the majority of students live in Cambridge (55%) followed by Boston (25%).

Many other intangibles and indirect benefits such as cultural, aesthetic and the "pull" of industry to the area can be attributed to M.I.T.

The net result affirmatively resolves the fact that M.I.T. is of great economic benefit to Cambridge and the SMSA.

#### Suggestions for Future Research

Although this thesis supports the hypothesis, it does not establish the relationship of the Institute to the character of the area. Additional work is suggested to see if any definite relationship exists between the Institute's activities and character, and that of the surrounding communities. Such factors as income, education, distance from M.I.T. and accessibility, type of industry, etc. should be considered to ensure more accurate predictions of impact as well as measurements.

Additional work is also required in procedures of analysis and to establish standards of measurement for the many tangibles which occur in cases of educational institutions.

**APPENDICES**

APPENDIX I

Typical Statements by Public Figures Regarding the Value of a University

Kennedy, John F., President of the United States, in his message to M.I.T. upon its Centennial, 1961 -

"---There are few Americans who have not benefitted from M.I.T.---."

Fisk, James B., President of Bell Telephone Laboratories. In Boston Sunday Herald's Special Magazine Section - M.I.T., A Century of Leadership, 1861-1961, p 44.

"M.I.T. and other institutes of technology in the country are among the great strengths of our nation. Without them and their output products, both in ideas and men, modern industry would falter and fade."

Danilov, Victor J., Executive Editor, Industrial Research Magazine. In a special report, Sites for Science, May 1963 issue, pp 17-23.

"The clustering effect (of research and other scientific facilities) is greatest around the nations leading scientific and technological institutions."

The answer to 55% of the replies received from a questionnaire to determine what locational factors affected the satisfactory operation of large research and development laboratories in New York State was, "Proximity to universities."

Webb, James E. Administrator of NASA. In his report to Congress on the proposed Electronic Research Center. Section C of Survey of Locations.

"After considerable thought and discussion, the committee concluded that the following four criteria were of fundamental importance in the initial identification of areas warranting further study: (1) Proximity of educational institutions that have great strength and proven research potential at graduate levels in engineering and science; (2)---; (3) An established, research-oriented, science-engineering community; (4)----. The committee further agreed that, of these four criteria, the first, proximity of graduate-level, research-oriented educational institutions, was considered to be the most important."

Terman, Frederick Emons, Vice President and Provost, Stanford University,

quoted in Appendix C1 of aforementioned Report on the Electronic Research Center.

"Universities are thus rapidly developing into more than mere places for learning. They are becoming major economic influences in the nation's industrial life, affecting the location of industry, population growth, and the character of communities. Universities are in brief a natural resource just as are raw materials, transportation, climate, etc."

"Industry is finding that for those activities that involve a high level of scientific and technological creativity, a location in a center of brains is more important than a location near markets, raw materials, transportation, or factory labor."

Benezet, Louis T., President Colorado College. In a speech at the Workshop in Financing Higher Education at Boulder, Colorado, June 1958.

"The very presence of a college or university in a community is not a drain on the economy. It is a positive pillar to that economy, in two important ways: In the first place, as it stands, it is one of the best businesses any community can wish for"---(followed by data on employment and expenditures).

Yale University, "Yale in New Haven", Yale 1962

P 8. "It is not only the cultural contributions of universities that account for their desirability: a university can be an enormous financial asset to the community in which it is located. The economic benefits which Yale brings to the New Haven area are proof of this:" (followed by employment figures and expenditures but omitting costs).

p 14. "Today cultural and intellectual resources are decisive considerations in plant locations.----The success of their operations depends on brain power - on the first rate scientists, technicians and executives who develop their small but valuable products. To hire and hold these men, according to a recent article in Harpers Magazine, management needs a location which will appeal to them. Two powerful attractions are (1) a pleasant environment to live in and (2) a great university----."

Kerr, Clark, President of University of California, The Uses of the

University, Harvard University Press, Cambridge, Mass., 1963, pp. 76-77.

"Federal research centers, whenever possible, should be located near and identified with a university. A university, with its libraries, colleagues to talk to, and graduate students to train, provides a uniquely favorable environment for such centers."

Killian, James R. Jr., Chairman of the Corporation, Massachusetts Institute of Technology, in an address at the University Club, Boston, January 21, 1960.

"Our educational institutions are in the front rank; indeed, they are a great national and world resource. Together with our medical institutions and our research-based industries, they have made Metropolitan Boston one of the nation's primary research centers, a great radiating and invigorating source of better health, new ideas, and new enterprise."

APPENDIX II

Annotated List (partial) of Economic Impact Studies

Rorholm, Niels, Economic Impact of Narraganset Bay, Bulletin 374, Agricultural Experiment Station, University of Rhode Island, Kingston, R.I., 1963.

Focuses on the effects that Narraganset Bay has upon the state of Rhode Island plus the economic impact of the Bay on its surrounding communities. Estimates some monetary impacts associated with the Bay by category of activity. The study also lists the stimulated sales due to ship and boat building, the source of revenue. It deals with the Bay as a resource and concludes that "the Bay can become Rhode Island's most important resource".

University of Maryland, Bureau of Business and Economic Research, "Industry as a Local Tax Base, Vol. 14, No. 1, June 1960. Studies in Business and Economics.

Analyzes the problem of evaluating the advantages and disadvantages of expanding or new manufacturing plants to their communities. Points out the assumption that new business and employees automatically increase the tax base and revenue is clearly fallacious. Concludes that a community can ascertain the facts only by careful, intensive study of each case.

M.I.T. Transportation Engineering Division, Economic Impact Study of Mass. Route 128.

Focus on the economic impact of Mass. Route 128, principally upon the shift in location of industrial facilities from the central city to new locations along Route 128. Contains a brief analysis of the impact of industry on the real estate values of one town.

Doody, Francis S., Dr., "The Immediate Economic Impact of Higher Education in New England", Boston University, Bureau of Business Research, 1961.

Concerned principally with the flow of money into and out of New England as a result of higher education in the New England States. Consolidates all colleges of each state for statewide figures. Concludes that higher education is of tremendous value to New England by generation of funds, jobs and business.

Harvey, James W., The University and The City, Bureau of Public Administration, University of California, Berkely, 1958.

A study of the economic relationships between the University of California and the City of Berkely. Examines the situation and shows the part that the university plays in the economy of the city. Concludes that Berkely is dependent, in part, on the university employment and real estate values.

Rutgers University, Bureau of Economic Research, The Contribution of Rutgers to the Economy of the City of New Brunswick during the Calendar Year 1959.

Measures the contribution, by category of activities, that Rutgers makes in the City of New Brunswick and its trading area. Each component part of the university, that is, students, administration, faculty and staff, were measured separately for each category.

Government Document, Report of NASA, Electronic Research Center, Government Printing Office, 1964.

A study of site location investigation for NASA's proposed Electronic Research Center. Includes some forecasts of economic impact upon the communities being considered as possible sites for the Center.

Hoyt, Homer Associates, Economic Survey of the Land Uses of Evanston, Illinois, 1949.

Although a survey document, it includes some data on the impact of Northwestern University on Evanston, Illinois and concludes that the University is an important part of the economic base of the city.



Hekler, H. M., The Impact of Offices on Rye, New York, Unpublished Master's Thesis (City Planning), M.I.T., 1964.

Investigates the cost-revenue relationships of office buildings on Rye, New York. It concludes they are of economic benefit to the city as they produce greater revenues than they cost.

Laben, K. E., The Economic Impact of a Defense Installation Upon the Surrounding Communities. Unpublished Master's Thesis (Industrial Management), M.I.T. 1961.

Investigates the economic impact of Pease Air Force Base, New Hampshire upon its area. Concludes the installation has a great impact on the area but the impact differs markedly from that of an industrial enterprise. Furthermore it concludes that the impact on the area is a function of the amount of service the area can give the installation.

Kraushaar, John L., "How Much of an Asset is a College", College and University Business, Feb. 1964.

Measures the economic benefits of the University of Bridgeport, Conn. to its area. Concludes that higher education, a basic source of income and employment, is a relatively new and increasingly important source of employment and income in the area.

APPENDIX III

Data Section

TABLE 1  
Population of Cambridge<sup>(1)</sup>

YEAR	POPULATION	REMARKS
1900	91,886	
1910	104,839	
1916	107,000 (estimate)	M.I.T. moved to Cambridge
1920	109,694	
1930	113,643	
1940	110,874	
1950	120,740*	Estimated at 110,000 w.o college students
1960	107,716*	Estimated at 98,000 w/o college students

(1) SOURCE: United States Census, 1960

\* Prior to the 1950 Census college students were enumerated at their legal residences. In 1950 and 1960 they were enumerated at their actual, i.e. college, residences.

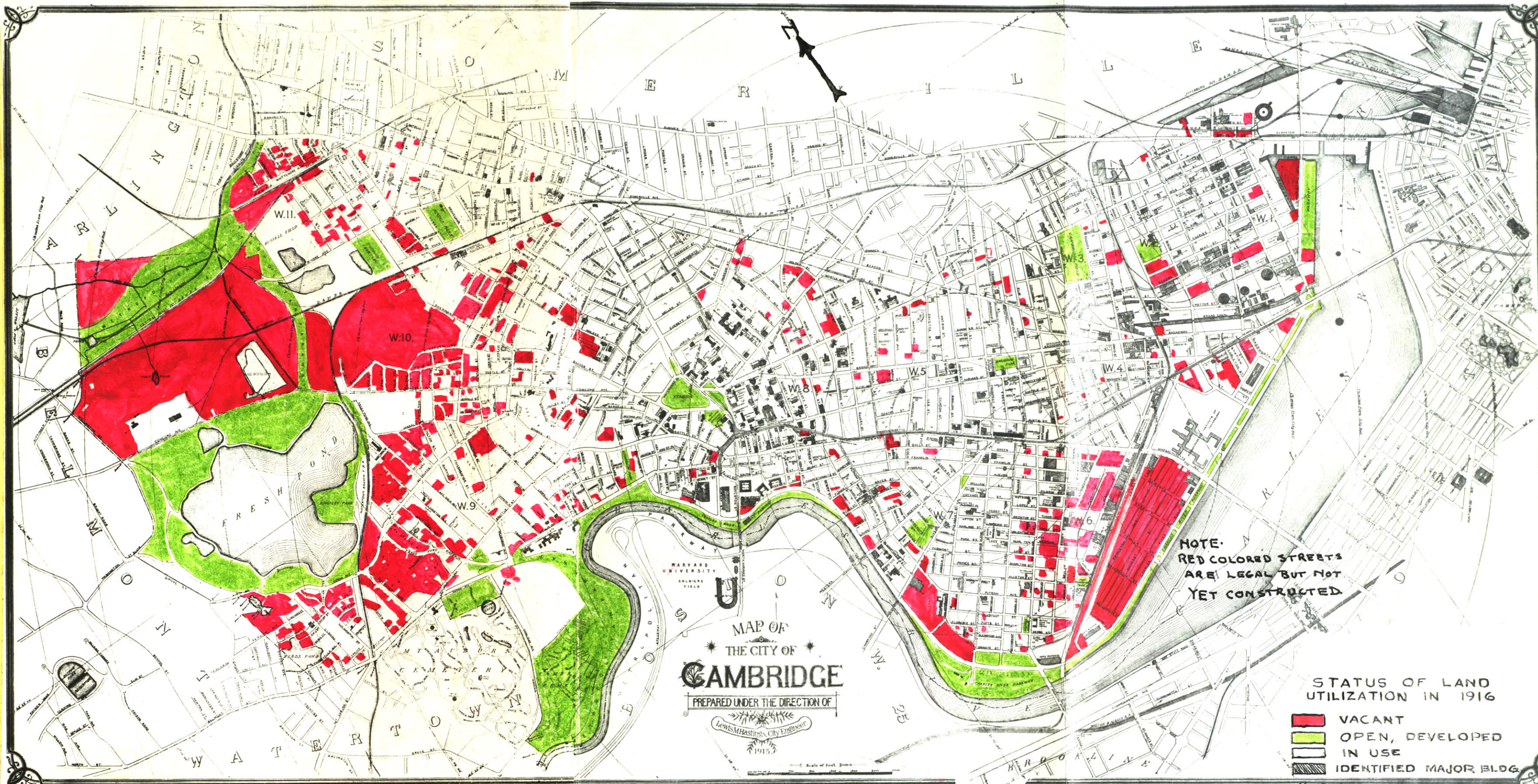
APPENDIX III

TABLE 2

M.I.T. GENERAL STATISTICS  
(Excluding Lincoln Labs)

LAND ACRES	ACADEMIC YEAR 1962-63
In Cambridge, Total	123
In Cambridge, Tax Exempt	111
STUDENT REGISTRATION	
Total	6695
Mass. Residents	1703
Foreign Students	814
Regular Summer Students	1668
Special Summer Students	2892
EMPLOYEES	
Total, Including Faculty	8000
Instructing Staff, Total	2241
Instructing Staff, Faculty Rank	773
	\$ MILLIONS
EDUCATION PLANT VALUE	60
ASSETS, TOTAL	240
REVENUES, TOTAL	94.3
EXPENSES OF CURRENT OPERATIONS	
Total	33.7
Purchases, Total	23.6
Purchases in Boston SMSA	21.9
Plant Operation	4.9
Dining and Student Housing	2.2
PAYROLLS	
Total	28.5
In Boston SMSA	23.6
MISCELLANEOUS	
Construction, Budget	39.1

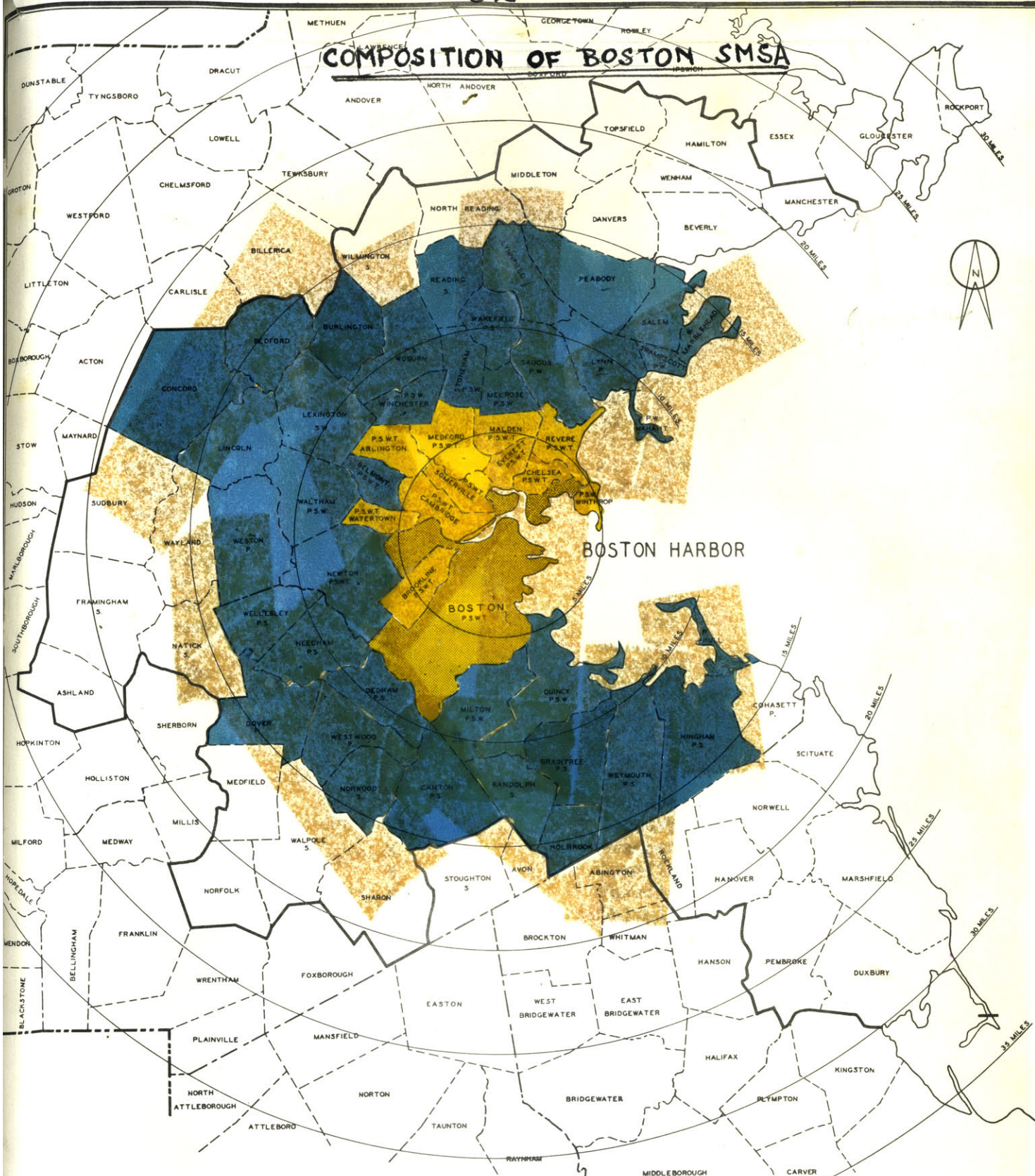
SOURCES; Presidents Report 1963  
Treasurers Report 1963, Misc. Comptrollers Reports 1963.



S. 9315.2

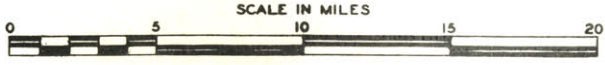
FIGURE 1

# COMPOSITION OF BOSTON SMSA



OUTLINE MAP OF THE VARIOUS BOSTON METROPOLITAN DISTRICTS

THE COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF COMMERCE  
DIVISION OF PLANNING



### LEGEND

- BOSTON METROPOLITAN AREA AS DEFINED FOR 18TH UNITED STATES CENSUS, 1960
- - - STATE BOUNDARY LINES
- - - COUNTY BOUNDARY LINES
- - - CITY AND TOWN BOUNDARY LINES
- - - METROPOLITAN DISTRICTS
- P — PARKS    S — SEWERAGE
- W — WATER    T — TRANSIT

- CORE - 12 CITIES + TOWNS
- INNER SUBURBS - 39 "
- OUTER SUBURBS - 25 "

FIGURE 7

TOTAL 76 "

APPENDIX III

TABLE 3

Composition of Boston SMSA  
(1960 US Census)

	CORE	INNER	OUTER		CORE	INNER	OUTER
	SUBURBS	SUBURBS	SUBURBS		SUBURBS	SUBURBS	SUBURBS
Arlington	x			Nahant		x	
Ashland			x	Natick			x
Bedford		x		Needham		x	
Belmont		x		Newton		x	
Beverly			x	Norfolk			x
Boston	x			North Reading			x
Braintree		x		Norwell			x
Brookline	x			Norwood		x	
Burlington		x		Peabody		x	
Cambridge	x			Pembroke			x
Canton		x		Quincy		x	
Chelsea	x			Randolf		x	
Cohasset			x	Reading		x	
Concord		x		Revere	x		
Danvers			x	Rockland			x
Dedham		x		Salem		x	
Dover		x		Saugus		x	
Duxbury			x	Scituate			x
Everett	x			Sharon		x	
Framingham			x	Somerville	x		
Hamilton			x	Stoneham		x	
Hanover			x	Sudbury			x
Hingham		x		Swampscott		x	
Holbrook		x		Topsfield			x
Hull		x		Wakefield		x	
Lexington		x		Walpole			x
Lincoln		x		Waltham		x	
Lynn		x		Watertown	x		
Lynnfield		x		Wavland			x
Malden	x			Wellesley		x	
Manchester			x	Wenham			x
Marblehead		x		Weston		x	
Marshfield			x	Westwood		x	
Medfield			x	Weymouth		x	
Medford	x			Wilmington			x
Melrose		x		Winchester		x	
Middleton			x	Winthrop	x		
Milton		x		Woburn		x	
				TOTAL	12	39	25 = 76

NOTE: Division into Core, Inner and Outer Suburbs is an arbitrary compromise between Boston Chamber of Commerce and Greater Boston Economic Study Committee's definition.

APPENDIX III

Table 4

SUMMARY OF COSTS - BENEFITS  
TO CAMBRIDGE AND THE BOSTON SMSA

Item	<u>Cambridge</u>		<u>Boston SMSA</u> (1)	
	Cost	Benefit	Cost	Benefit
<b>DIRECT</b>				
Taxes, Real Estate		+		
Land Utilization*				
<b>Municipal Services</b>				
Utilities		+		
Police	-			
Fire	-			
Refuse Collection	-			
Inspections, Permits*				
Street Servicing		+		
Welfare				
Recreation, Library*				
General Administration*				
<b>Economic</b>				
Flow of money into area		+		+
Employment		+		+
Purchase and Construction		+		+
Urban Renewal Credits		+		
Reduction in Captial Costs		+		
<b>INDIRECT</b>				
Magnet Affect on Industry		+		+
Effects on Business and Employment		+		+
Cultural Use of Facilities		+		+
Aesthetics		+		+

(1) Entries made in this column only when a result can be positively credited as being caused by M.I.T.

(\*) No entries for this item.

APPENDIX III

TABLE 5

STATISTICAL SUMMARY OF LAND USE IN CAMBRIDGE 1957

Category of Property	Actual Acreage	Percent of Total
Residential	1254.39	31.32
Commercial	249.36	6.24
Industrial	763.54	19.08
Churches & Private Institutions	125.41	3.13
Public & Community Facilities	542.15	13.55
Colleges & Universities	260.59	6.51
Vacant	165.76	4.14
Streets & Ways	<u>640.78</u>	<u>16.06</u>
TOTAL	4002.48	100.00

DEFINITIONS:

Churches & Private Institutions - Institutional Property NOT owned by a College or University.

Public & Community Facilities - Property of Governments and their Authorized Agencies.

Colleges & Universities - TAX EXEMPT Property owned by Colleges and Universities, including M.I.T.

Vacant - Usable land awaiting development or use, including temporary storage.

SOURCE: Cambridge Planning Board, The City Plan, CP 20, Dec. 1957



APPENDIX III

TABLE 6

CORPORATIONS PAYING OVER \$100,000  
IN TAXES OR PAYMENTS IN LIEU OF TAXES  
TO CAMBRIDGE IN 1963 (1)

Massachusetts Institute of Technology <sup>2</sup>	724,584
Harvard University <sup>3</sup>	298,879
Cambridge Electric Light Company	196,504
Simplex Wire and Cable Company	184,186
Polaroid Corporation	169,067
(N.E. Mutual) \$100 Memorial Drive <sup>4</sup>	150,464
Boston and Maine Railroad	136,524
Cambridge Gas Light Company	136,134
Boston Woven Hose & Rubber Company	121,924
Technology Square	120,422
Arthur D. Little, Inc.	103,281
W.R. Grace (Dewey & Almy Company)	101,742

(1) Source: Assessors Office, Cambridge, thru Cambridge Planning Board, except for M.I.T.'s figures.

(3) Excluding taxes paid by Arthur D. Little on property leased from Harvard University.

(4) Excluding taxes paid by Arthur D. Little on property leased from N.E. Mutual Life Insurance Co.

APPENDIX III

TABLE 7

TAX EXEMPT PROPERTY IN CAMBRIDGE, 1963

Ownership	Acres <sup>(1)</sup>	% of Cambridge's Land <sup>(2)</sup>	% Tax Exempt Land
U. S. Government	9.2	.2	.4
Commonwealth of Massachusetts and Agencies	222.2	5.5	10.3
Middlesex County	4.8	.1	.2
City of Cambridge All Municipal Property Excluding Streets & Ways	880.7	22.0	40.7
City of Cambridge Streets and Ways	640.8	16.0	29.7
Benevolent and Charitable	23.8	.5	1.1
Religious Including Churches, Schools and Cemeteries	62.8	1.5	2.9
Cemeteries Excluding City's and Religious	16.1	.4	.7
Miscellaneous Non Profit Organizations	1.3	.0	.1
Schools and Colleges	<u>299.6</u>	<u>7.4</u>	<u>13.9</u>
TOTAL	2161.3	53.6	100.0

(1) Total Acreage in Cambridge is 4002.5.

(2) To nearest 0.1%.

SOURCE: City of Cambridge, Tax Exemption List, 1963.

APPENDIX III

TABLE 8

TAX EXEMPT PROPERTY OF SCHOOLS & COLLEGES, 1963

	Acres <sup>(1)</sup>	Percent of Cambridge's Land	Percent of Tax Exemption Total <sup>(1)</sup>
SCHOOLS			
Browne & Nichols	8.9	.2	3.0
Buckingham	7.0	.1	2.3
Cambridge Nursery	.3	-	.1
New Church Theological	2.3	-	.8
Longley School of Music	.5	-	.2
Shady Hill	<u>10.5</u>	<u>.2</u>	<u>3.5</u>
Total Schools	29.5	0.7	9.9
COLLEGES			
Cambridge Jr.	.7	-	.2
Leslie	3.4	-	1.1
Radcliffe	18.1	.4	6.0
Harvard	136.1	3.4	45.4
MASSACHUSETTS INSTITUTE OF TECHNOLOGY	<u>111.5</u>	<u>2.7</u>	<u>37.7</u>
Total Colleges	270.2	6.7	90.2
Total Schools & Colleges	299.6	7.4	100.0
Total Land in Cambridge	4002.5		

(1) To nearest 0.1%. Total may vary slightly.

SOURCE: City of Cambridge, Tax Exemption List, 1963.

APPENDIX III

TABLE 9

LEADING EMPLOYERS IN THE BOSTON SMSA  
(Non Governmental)

RANK SMSA CAM- BRIDGE	NAME	NUMBER OF EMPLOYEES(1)	SMSA PLANT LOCATIONS
1	Raytheon Co.	18,000 <sup>a</sup>	Boston SMSA Only
2	Sylvania Electric Co.	15,000 <sup>b</sup>	All Boston Area Plants
3	General Electric Co.	14,200 <sup>b</sup>	Lynn
4	New England Telegraph & Telephone Co.	13,900 <sup>c</sup>	Boston
5	Stop & Shop	13,900 <sup>c</sup>	Boston
6	1 Harvard University	11,000 <sup>a*</sup>	Cambridge, Boston
7	2 <u>MASSACHUSETTS INSTITUTE OF TECHNOLOGY</u>	8,000 <sup>a*</sup>	Cambridge
8	Jordan Marsh Co.	7,600 <sup>a</sup>	Boston, Framingham, Peabody, Malden
9	B.F. Goodrich Footwear Co.	5,500 <sup>b</sup>	Watertown
10	John Hancock Mutual Life Insurance Co.	5,500 <sup>c</sup>	Boston
11	Boston & Maine Railroad	5,000 <sup>c</sup>	Boston
12	Massachusetts General Hospital	4,200 <sup>c</sup>	Boston
13	First National Bank of Boston	4,200 <sup>c</sup>	Boston
14	Boston Edison Co.	4,100 <sup>c</sup>	Boston
15	3 Polaroid Corporation	3,500 <sup>b</sup>	Cambridge
16	Avco	3,400 <sup>a</sup>	Everett 600 Wilmington 2800
	4 American Biltrite Rubber Co.	1,500 <sup>b</sup>	Cambridge
	5 Arthur D. Little Inc.	1,500 <sup>c</sup>	Cambridge
	6 Brighams, Inc.	1,300 <sup>b</sup>	Cambridge
	7 Carr Fastener Corporation	1,200 <sup>b</sup>	Cambridge
	8 Simplex Wire & Cable	1,000 <sup>b</sup>	Cambridge
	9 New England Confectionery Co.	850 <sup>b</sup>	Cambridge
	10 Dewey & Almy Chemical Div.	800 <sup>b</sup>	Cambridge

\* Includes Faculty  
(1) To nearest 100

SOURCES:

- a Obtained directly from Organization
- b Boston Chamber of Commerce, Directory of Manufacturers, 1964-65
- c Boston Chamber of Commerce Mimeo List, January 1963

APPENDIX III

TABLE 10

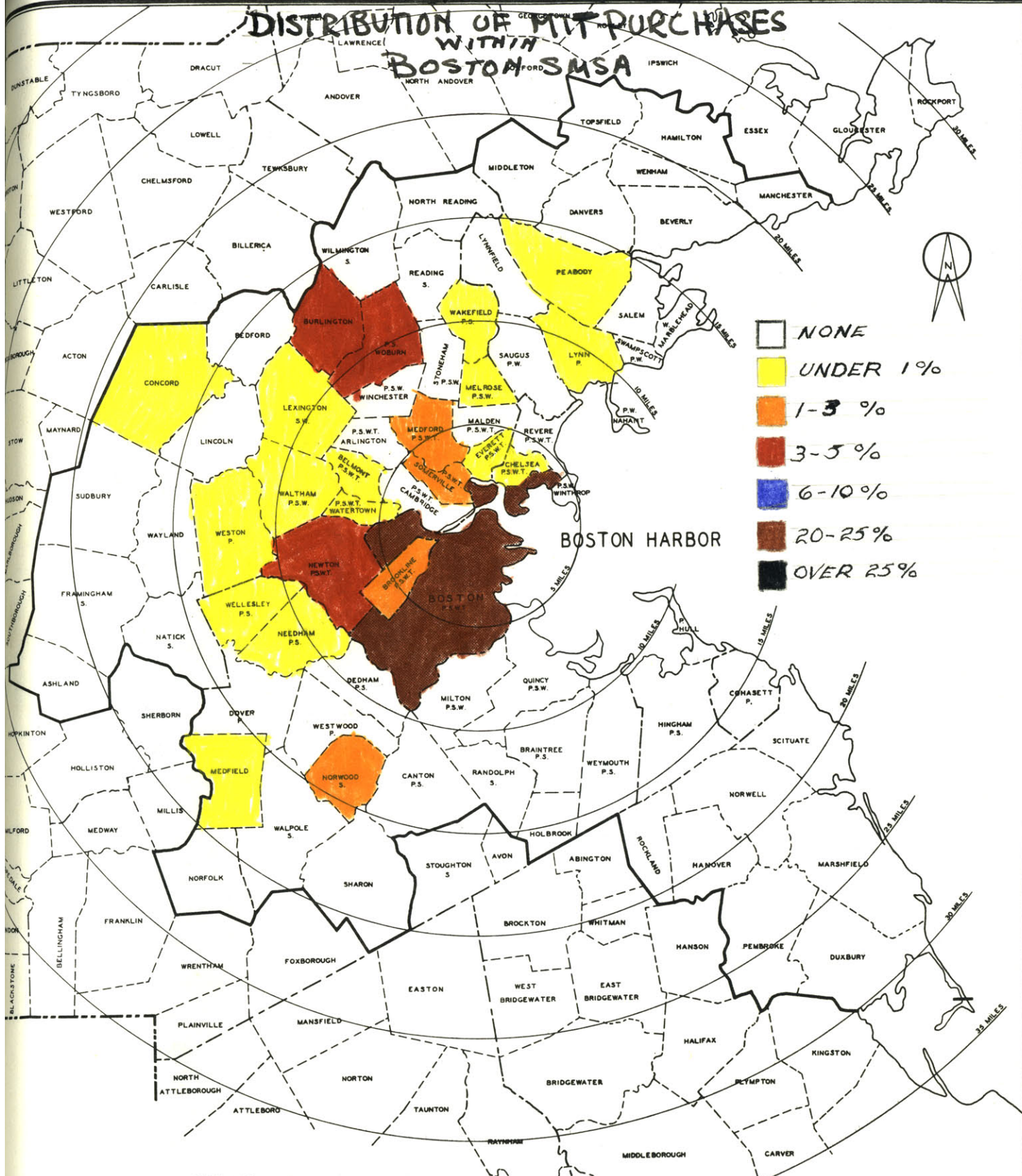
DISTRIBUTION OF PURCHASE ORDERS, M.I.T.  
1 July 1962-30 June 1963

\$ AMOUNT OF ORDER	NUMBER OF ORDERS	PERCENT OF TOTAL ORDERS	DOLLAR VALUE (\$000)	PERCENT OF \$ VALUE
To 499	78,375	92.5		
500- 999	3,447	4.1		
1000- 1999	1,444	1.7		
2000- 4999	892	1.1		
<hr/>				
Subtotal	84,158	99.3	12,065	51.1
<hr/>				
5000- 9999	337	0.4		
10,000- 24,999	199	0.2		
Over 25,000	64	0.0		
<hr/>				
Subtotal	600	0.7	11,529	48.8
<hr/>				
TOTAL	84,758	100.0*	23,594	100.0

\* Not exact total due to rounding of figures to nearest 0.1%.

SOURCE: M.I.T. Comptroller's Reports of Purchases, FY 1963.

# 7 DISTRIBUTION OF MIT PURCHASES WITHIN BOSTON SMSA



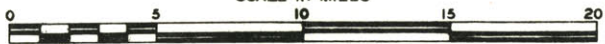
- NONE
- UNDER 1%
- 1-3%
- 3-5%
- 6-10%
- 20-25%
- OVER 25%

OUTLINE MAP OF THE VARIOUS  
BOSTON METROPOLITAN DISTRICTS

LEGEND

- BOSTON METROPOLITAN AREA AS DEFINED FOR 18TH UNITED STATES CENSUS, 1960
- STATE BOUNDARY LINES
- COUNTY BOUNDARY LINES
- CITY AND TOWN BOUNDARY LINES
- METROPOLITAN DISTRICTS
- P — PARKS      S — SEWERAGE
- W — WATER     T — TRANSIT

THE COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF COMMERCE  
DIVISION OF PLANNING  
SCALE IN MILES



APPENDIX III

TABLE 11

DISTRIBUTION OF M.I.T.'S PURCHASES  
WITHIN THE BOSTON AREA

	Actual Purchases (All Types)	%	Purchase Orders (Over \$5,000 Only)	%
TOTAL Purchases M.I.T. FY 63	23,594,000 (1)	100	\$11,529,000 (1)	100
Identified in Boston SMSA	21,964,000 (2)	93.0	3,805,559 (3)	33.0
CITY OR TOWN	AMOUNT	% OF SMSA	AMOUNT	% OF SMSA
Arlington			81,500	2.1
Belmont	26,700	.1	60,200	1.5
Boston	12,644,000	57.5	1,640,500	42.2
Brookline	487,100	2.2	13,200	.3
Burlington	1,015,900	4.6	103,300	2.6
Cambridge	4,210,000	19.7	713,000	18.7
Canton	10,000	-		
Chelsea	29,600	.1		
Concord	110,700	.5	38,900	1.0
Danvers	1,500	-		
Dedham	424,200	1.9	5,400	.1
Everett	41,100	.2	44,400	1.1
Framingham	12,600	-	16,400	.4
Hanover	400	-		
Lexington	24,200	.1	17,900	.5
Lynn	77,300	.4	5,500	.1
Malden	8,900	-		
Medfield	34,700	.2		
Medford	218,600	1.0		
Melrose	18,500	.1		
Milton	200	-	5,700	.1
Natick	3,100	-	154,600	4.1
Needham	180,200	.8		
Newton	713,700	3.2	280,600	7.4
Norwood	38,300	1.7	8,100	.2

TABLE 11 (con't)

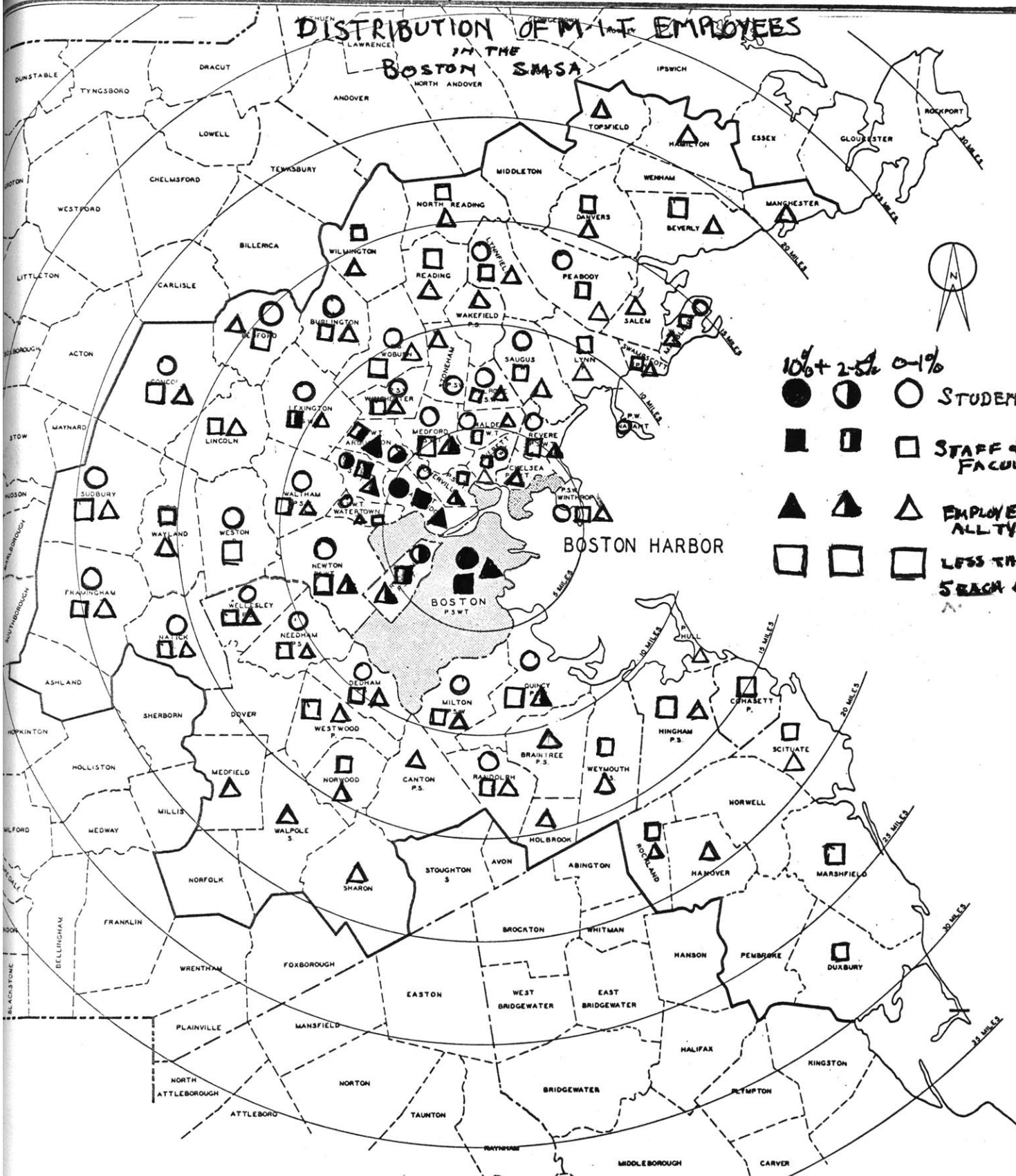
CITY OR TOWN	Actual Purchases (All Types)		Purchase Orders (Over \$5,000 Only)	
	AMOUNT	% OF SMSA	AMOUNT	% OF SMSA
Peabody	107,800	.5		
Salem			17,200	.5
Sharon	5,300	.1		
Somerville	229,400	1.0	79,000	2.0
Stoneham	3,200	-	5,500	.1
Swampscott			5,300	.1
Wakefield	181,900	.8	22,400	.6
Waltham	74,900	.3	240,100	6.3
Watertown	51,700	.2	159,400	4.2
Wayland			12,700	.3
Wellesley	135,400	.6	40,000	1.1
Weston	79,100	.4		
Westwood	300	-		
Wilmington	3,200	-	34,800	.9
Woburn	760,800	3.5		

- (1) Comptroller's Reports, FY 1963.
- (2) Taken from a 2% sample of actual invoices for first half of FY 1963.
- (3) Taken by complete count of listed Purchase Orders in Comptroller's Report FY 1963.

NOTE: Towns of SMSA which had no activity are omitted.



# DISTRIBUTION OF MET EMPLOYEES IN THE BOSTON SMSA



10%+ 2-9% 0-1%

● ◐ ○ STUDENTS

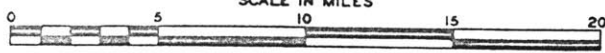
■ ◐ □ STAFF & FACULTY

▲ ◐ △ EMPLOYEES ALL TYPE

◻ ◻ ◻ LESS THAN 5 EACH

OUTLINE MAP OF THE VARIOUS BOSTON METROPOLITAN DISTRICTS

THE COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF COMMERCE  
DIVISION OF PLANNING  
SCALE IN MILES



### LEGEND

- BOSTON METROPOLITAN AREA AS DEFINED FOR 18TH UNITED STATES CENSUS, 1960
- - - STATE BOUNDARY LINES
- - - COUNTY BOUNDARY LINES
- - - CITY AND TOWN BOUNDARY LINES
- METROPOLITAN DISTRICTS
- P — PARKS S — SEWERAGE
- W — WATER T — TRANSIT

SOURCE: TABLE 12+

FIGURE 4

APPENDIX III

TABLE 12

DISTRIBUTION OF THE M.I.T. FAMILY  
IN THE  
BOSTON STANDARD METROPOLITAN STATISTICAL AREA

The M.I.T. Family consists of all the personnel, including the Faculty and Division of Sponsored Research of the Cambridge Complex only. Lincoln Lab. personnel are excluded from all categories. Graduate students with staff appointments are listed in both the Academic and Student categories. All other students, regular and special, with or without fellowships, scholarships, etc. are included in the Student Column only.

	Acad., Admin. & Prof. Staffs(1)		Clerical Type Employees(2)		Other Employees(2)		Students(3)	
	No.	%	No.	%	No.	%	Enrolled	%
Total Employed By M.I.T.	4979	100	Unknown	-	Unknown	-	6925	100
Total in SMSA	3607	73	1795	-	2175	-	6479	93

CITY OR TOWN	No.	% OF SMSA	NO.	% OF SMSA	NO.	% OF SMSA	NO.	% OF SMSA
Arlington	159	4.4	135	7.5	80	3.7	139	2.1
Ashland	2	X	*	X	*	X	2	X
Bedford	22	.6	20	1.1	*	X	16	.2
Belmont	175	4.8	50	2.8	30	1.4	74	1.1
Beverly	8	.2	5	.3	*	X	2	X
Boston	575	16.0	465	26.0	605	27.8	1677	25.8
Braintree	4	.1	10	.6	25	1.1	4	X
Brookline	183	5.1	70	3.9	15	.7	239	3.7
Brulington	17	.5	10	.6	5	.2	21	.3
Cambridge	1214	33.7	390	22.0	300	13.8	3594	55.5
Canton	2	X	5	.3	5	.2	1	X
Chelsea	4	.1	*	X	30	1.4	4	X
Cohasset	8	.2	*	X	*	X	2	X
Concord	55	1.5	25	1.4	5	.2	15	.2
Danvers	8	.2	5	.3	10	.5	4	X
Dedham	110	.3	5	.3	20	.9	6	.1
Dover	2	X	*	X	*	X	*	X
Duxbury	5	.1	*	X	*	X	*	X
Everett	10	.3	15	.8	35	1.6	7	.1
Framingham	27	.7	*	X	5	.2	15	.2

TABLE 12 (con't)

CITY OR TOWN	Acad., Admin. & Prof. Staffs(1)			Clerical Type(2)			Other (2)			Total		
	NO	100	%	NO	100	%	NO	100	%	NO	100	%
Hamilton	*	*	*	X	10	.5	2	X				
Hanover	3	X	5	.3	*	X	*	X				
Hingham	12	.3	10	.6	5	.2	*	X				
Holbrook	2	X	5	.3	15	.7	2	X				
Hull	1	X	*	X	5	.2	1	X				
Lexington	178	4.9	30	1.6	25	1.1	58	.9				
Lincoln	39	1.0	10	.6	5	.2	3	X				
Lynn	7	.2	5	.3	30	1.4	4	X				
Lynnfield	10	.3	10	.6	*		5	X				
Malden	10	.3	15	.8	35	1.6	20	.3				
Manchester	*	X	*	X	5	.2	*	X				
Marblehead	30	.8	10	.6	5	.2	8	0.1				
Marshfield	5	.1	*	*	*		*	X				
Medfield	2	X	5	.3	5	.2	1	X				
Medford	20	.6	45	2.5	85	3.9	34	.5				
Melrose	14	.4	10	.6	20	.9	7	.1				
Middleton	1	X	*	X	*	X	1	X				
Milton	12	.3	15	.8	25	1.1	11	.2				
Nahant	3	X	*	X	*	X	8	.1				
Natick	21	.6	25	1.4	5	.2	11	.2				
Needham	26	.7	5	.3	5	.2	5	X				
Newton	162	4.5	35	2.0	45	2.0	74	1.1				
Norfolk	1	X	*	X	*	X	1	X				
No. Reading	6	.1	*	X	20	.9	2	X				
Norwell	2	X	*	X	*	X	*	X				
Norwood	12	.3	15	.8	5	.2	2	X				
Peabody	13	.4	*	X	10	.5	8	.1				
Pembroke	*		*	X	*	X	*	X				
Quincy	17	.4	40	2.2	75	3.5	13	.2				
Randolf	5	.1	5	.3	15	.7	5	X				
Reading	12	.3	5	.3	20	.9	3	X				
Revere	8	.2	25	1.4	45	2.0	14	.2				

TABLE 12 (con't)

CITY OR TOWN	Acad., Admin. & Prof. Staffs(1)		Clerical(2)			Other (2)		Total	
	Am't	%	Am't	%	Am't	%	Am't	%	
Rockland	6	.1	*	X	10	.5	1	X	
Salem	3	X	5	.3	10	.5	4	X	
Saugus	6	.1	25	1.4	35	1.6	7	.1	
Scituate	5	.1	5	.3	*	X	3	X	
Sharon	1	X	5	.3	5	.2	*	X	
Somerville	50	1.4	65	3.6	175	8.0	58	.9	
Stoneham	4	.1	5	.3	10	.5	5	X	
Sudbury	13	.4	*	X	10	.5	7	.1	
Swampscott	7	.2	10	.6	5	.2	4	X	
Topsfield	2	X	5	.3	*	X	*	X	
Wakefield	4	.1	10	.6	25	1.1	4	X	
Walpole	3	X	5	.3	*	X	1	X	
Waltham	42	1.1	20	1.1	45	2.0	35	.5	
Watertown	128	3.5	15	.8	40	1.8	154	2.4	
Wayland	19	.5	5	.3	*	X	1	X	
Wellesley	53	1.4	5	.3	*	X	13	.2	
Wenham	2	X	*	X	*	X	*	X	
Weston	27	.7	*	X	*	X	5	X	
Westwood	8	.2	10	.6	5	.2	2	X	
Weymouth	10	.3	10	.6	20	.9	2	X	
Wilmington	6	.1	*	X	10	.5	4	X	
Winchester	56	1.5	15	.8	25	1.1	19	.3	
Winthrop	13	.4	15	.8	15	.7	11	.2	
Woburn	15	.4	20	1.1	40	1.8	14	.2	
Total in SMSA	3607	97.9	1795	100.9	2175	98.4	6479	98.2	

(1) Administrative, Academic and Professional Staff numbers obtained from full count of Calendar Year 1963 Payrolls.

(2) Clerical and Other Employees numbers obtained by expanding a 20% sample of the Calendar Year 1963 Payrolls.

(3) Student count obtained by full count of Student Directory, Feb. 1964 ed. No differentiation was made of Regular of Special Students. Total 1964 enrollment 6925.

\* Did not appear in sampling.

X Insignificant figure or cannot be measured due to lack in sample.

NOTE: All figures to nearest 0.1%.

APPENDIX III

TABLE 13

DISTRIBUTION OF M.I.T. PAYROLLS  
IN THE  
BOSTON SMSA

Includes payrolls of all employed at M.I.T. including DSR employees, but excluding the non-staff students (part time and temporary) and Lincoln Laboratory employees. Graduate students with Staff Appointments are included in the Academic and Professional Category.

	Acad., Admin. & Prof. Staffs(1)		Clerical Type Employees(2)		Other Employees(2)		Total (2)	
	Amt \$000	%	Amt \$000		Amt \$000		Amt \$000	
Total Amt Paid By M.I.T.	28,541	100	Unknown		Unknown			
Total Amt SMSA	23,619	85	6,748		10,303		40,670	

CITY OR TOWN	Amt \$000(3)	% Of SMSA	Amt \$000(3)	% of SMSA	Amt \$000(3)	% Of SMSA	Total Amt \$000	% Of SMSA
Arlington	1206	5.1	378	5.5	423	4.1	2006	5.0
Ashland	X		*		*		X	
Bedford	192	.8	117	1.7	*		309	.8
Belmont	1700	7.1	212	3.1	129	1.2	2041	5.0
Beverly	76	.3	X		*		112	.3
Boston	2730	11.5	1758	26.0	2822	27.2	7309	18.0
Braintree	X		76	1.1	129	1.2	236	.6
Brookline	1102	4.7	X		127	1.2	1253	3.1
Burlington	153	.6	67	1.0	X		252	.6
Cambridge	5771	24.3	1338	19.7	1007	10.0	8115	20.0
Canton	X		X		X		67	.2
Chelsea	X		*		80	.8	96	.2
Cohasset	103	.4	*		*		103	.3
Concord	595	2.5	107	1.5	X		735	1.8
Danvers	X		X		X		83	.2
Dedham	76	.3	X	.3	105	1.0	141	.3
Dover	X		*		*		X	
Duxbury	X		*		*		X	
Everett	61	.3	320	.5	220	2.1	313	.7

TABLE 13 (con't)

CITY OR TOWN	Acad., Admin. & Prof. Staffs(1)		Clerical Type(2)		Other (2)		Students(3)	
	No.	%	No.	%	No.	%	Enrolled	%
Framingham	189	.8	*		X		224	.5
Hamilton	*		*		X		X	
Hanover	X		X		*		59	.1
Hingham	135	.5	53	.7	X		192	.5
Holbrook	X		X		X		67	.2
Hull	X		*		X		X	
Lexington	1956	8.3	92	1.3	86	.8	2133	5.2
Lincoln	458	1.9	81	1.2	X		542	1.3
Lynn	51	.2	X		123	1.2	209	.5
Lynnfield	99	.4	X		*		135	.3
Malden	54	.2	75	1.1	165	1.6	294	.7
Manchester	*		*		X		X	
Marblehead	258	1.2	X		X		338	.8
Marshfield	70	.3	*		*		70	.2
Medfield	X		X		X		81	.2
Medford	137	.6	138	2.1	422	4.0	697	1.7
Melrose	105	.4	68	1.0	148	1.4	321	7.8
Middleton	X		*		*		X	
Milton	106	.4	79	1.1	179	1.7	364	.9
Nahant	X		*		*		X	
Natick	169	.7	71	1.0	X		282	.7
Needham	225	1.0	X		X		282	.7
Newton	1253	5.3	157	2.3	192	1.8	1602	3.9
Norfolk	X		*		*		X	
No. Reading	X		*		136	1.3	176	.4
Norwell	X		*		*		X	
Norwood	84	.3	93	1.3	X		209	.5
Peabody	113	.5	*		79	.8	192	.5
Pembroke	*		*		*		*	
Quincy	123	.5	200	3.0	395	3.8	718	1.7
Randolf	X		X		109	1.0	152	.4

TABLE 13 (con't)

CITY OR TOWN	Acad., Admin. & Prof. Staffs(1)		Clerical Type(2)		Other (2)		Students(3)	
	No.	%	No.	%	No.	%	No.	%
Reading	115	.5	X		121	1.2	257	.6
Revere	56	.2	95	1.4	193	1.9	343	.8
Rockland	X		*		59	.6	98	.2
Salem	X		X		62	.6	90	.2
Saugus	X		129	1.9	122	1.1	287	.7
Scituate	X		X		*		X	
Sharon	X		X		X		59	.1
Somerville	229	1.0	241	3.6	827	8.0	1296	3.1
Stoneham	X		X		X		105	.3
Sudbury	116	.5	*		66	.6	182	.4
Swampscott	53	.2	X		X		117	.3
Topsfield	X		X		*		X	
Wakefield	X		X		96	.9	176	.4
Walpole	X		X		*		X	
Waltham	296	1.2	69	1.0	270	2.6	633	1.5
Watertown	744	3.1	58	.8	190	1.8	991	2.4
Wayland	210	.9	X		*		221	.5
Wellesley	521	2.2	X		*		538	1.3
Wenham	X		*		*		X	
Weston	345	1.4	*		*		345	.8
Westwood	95	.4	71	1.0	X		202	.4
Weymouth	78	.3	X		145	1.4	269	.7
Wilmington	X		*		X		89	.2
Winchester	597	2.5	X		111	1.1	753	1.8
Winthrop	80	.3	78	1.1	X		199	.5
Woburn	104	.4	155	2.3	214	2.1	473	1.1
	23619		6748		10303		40670	

(1) Amounts obtained from Comptrollers Report of complete 1963 payrolls.

(2) Amounts obtained by expanding a 20% sample of 1963 payrolls.

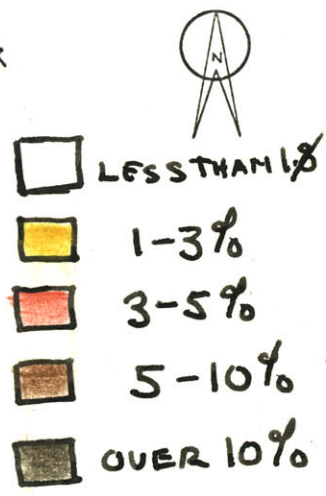
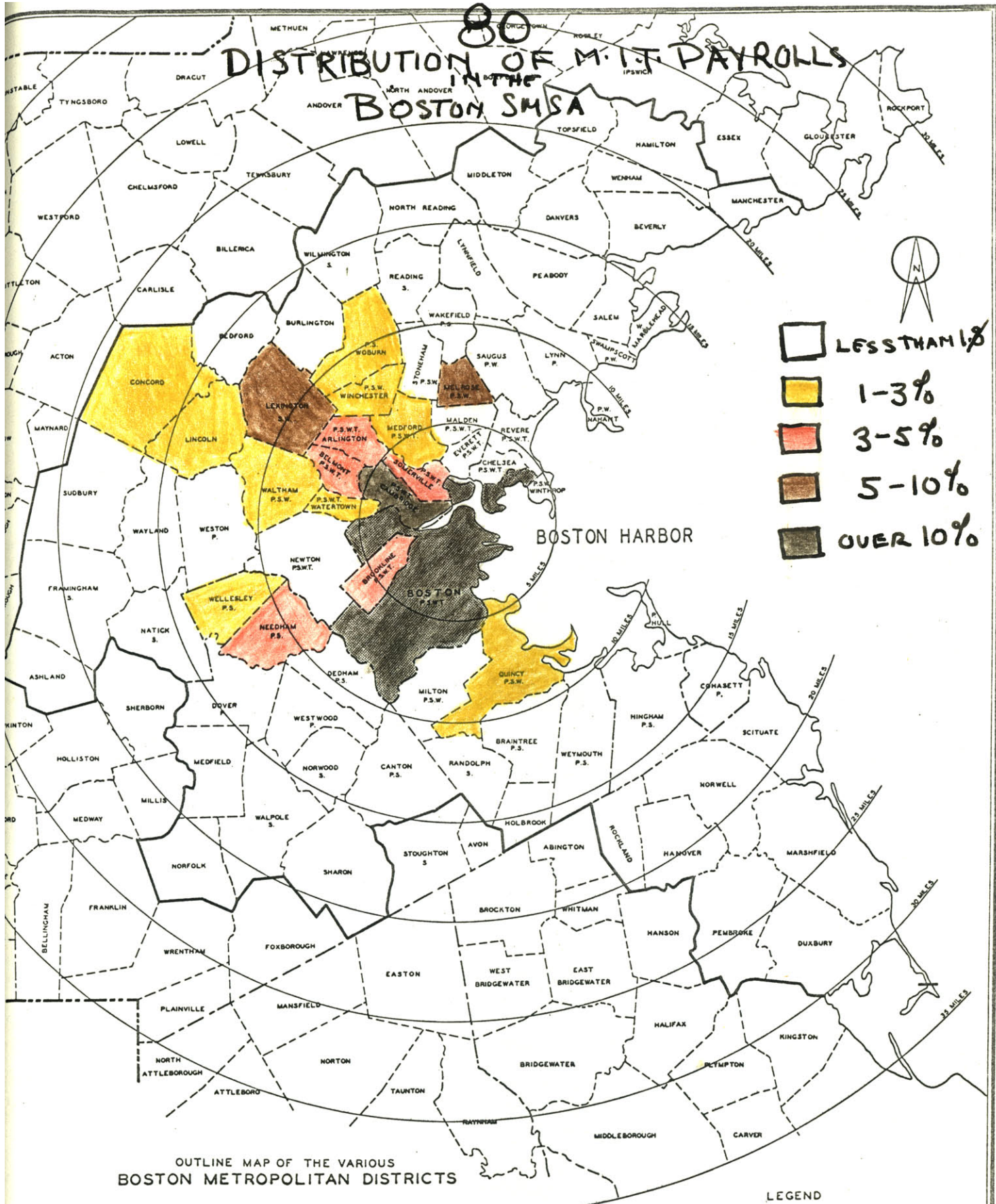
(3) Amounts of less than \$50,000 omitted & indicated by X.

\* Did not appear in sample.

\$ Amounts to nearest \$1000.

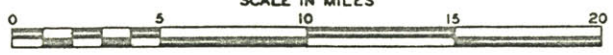
% to nearest 0.1%. Totals may not check.

# 80 DISTRIBUTION OF M.I.T. PAYROLLS IN THE BOSTON SMSA



OUTLINE MAP OF THE VARIOUS BOSTON METROPOLITAN DISTRICTS

THE COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF COMMERCE  
DIVISION OF PLANNING  
SCALE IN MILES



- LEGEND
- BOSTON METROPOLITAN AREA AS DEFINED FOR 18TH UNITED STATES CENSUS, 1960
  - STATE BOUNDARY LINES
  - - - COUNTY BOUNDARY LINES
  - - - CITY AND TOWN BOUNDARY LINES
  - METROPOLITAN DISTRICTS
  - P — PARKS    S — SEWERAGE
  - W — WATER    T — TRANSIT

FIGURE 5



APPENDIX III

TABLE 14

BUILDING AND MAJOR CONSTRUCTION SUMMARY<sup>(1)</sup>  
(FY 1961 - 63 INCL.)

	FISCAL YEAR		
	1962	1963	1964
Number of Major (New & Continuing) Projects (2).	34	27	35
Amount Shown As Costs During Indicated FY. (3)	21,833,000 <sup>(4)</sup>	22,364,000 <sup>(4)</sup>	23,597,000
Amount Budgetted During Indicated FY for Future Construction	Not Available	39,085,000	52,489,366
Major Dormitory Maintenance & Refurbishing Projects Not Included in Above Items (5)			
Number	6	1	5
Amount	470,000	651,000	240,000

- (1) Source: M.I.T. Comptroller's Report "Building and Major Construction Budget" for FY 1961, 1962, 1963. 62 Report Covers only 11 months.
- (2) Projects include deterred maintenance, major alterations, new buildings, major demolitions, major paving.
- (3) Costs include all associated costs, e.g. architects and engineers fees, materials, contracts, installed equipment and land if purchases. They are accounting costs and some do not result in actual payments.
- (4) Adjusted to reflect \$5,000,000 Magnet Lab costs carried over to FY 64.
- (5) Source: Director of Auxiliary Services, M.I.T.

#### APPENDIX IV

##### METHODOLOGY AND POSSIBLE SOURCES OF ERRORS

Readers of this document may want to quarrel with some of the data or to use some of it for other purposes. This section is included in order to permit such people to use and analyze the figures with a better background.

###### 1.) Use of Data of Different Years

Throughout this thesis there is use of data for one year with that of another. The main reason for so doing was the availability of the specific data coupled with the belief that any consecutive year would cause little or no change in comparisons. For example this author used 1962 annual per pupil school costs with the 1963 children population to obtain the total costs of Cambridge for educating M.I.T. children. The 1964 Student Directory was used for students on the same table as was the 1963 payroll data for other categories of personnel. The final comparison may have changed slightly if the data from the same years was used. However, this author is convinced that the final conclusions would be substantially the same.

###### 2.) Addresses

###### a.) Employees

Payrolls and residences were distributed by sampling methods except for the category Administrative, Academic and Professional. The sampling is indicated in footnotes of Table 12, Page 76. Because many people, particularly those terminating employment when moving, record their new address for Federal income tax purposes the distribution by the given addresses may well

be incorrect. The final distribution obtained by using the W-2 addresses results in showing a lesser impact than actually occurs to the local area. Earnings are normally spent at the point of earning, M.I.T.'s area, and not at the permanent address to which one moved after terminating employment.

b.) Students

Students were distributed according to term addresses as reported in the February 1964 Directory. There are a few students who live at or near the Institute but maintain term addresses elsewhere. No effort was made to correct for this fact as the number involved is considered too small to effect the final results.

c.) Businesses

The data on actual purchasing was obtained by taking a 2% sample of the Invoice Registers for six months. An assumption was made after discussing the matter with M.I.T.'s Purchasing Agent and the Accounting Section of the Comptroller's Office that the purchasing activity in any six-month period was fully representative of a full year's operations. Possibly a slightly different distribution may have been disclosed by taking a 1% for a full year.

Further error in locations could have occurred as the business was credited to the address which the invoice showed for remittance. For example IBM invoices request remittance to the Cambridge office of IBM. Therefore, Cambridge is credited with all IBM business although some may be conducted with other portions of the IBM system. These type errors are considered to be compensating.

3.) Use of Averages in Payrolls

Averages were used for calculating earnings of M.I.T. personnel for

those towns which had small numbers residing therein. This was done to provide anonymity. The computer program was designed not to show earnings which could be identified with particular men. As a result whenever a town had five or less employees the machine gave the total only. Table 12 (Page 74) was prepared by the use of the averages and may therefore incorrectly show those towns with small earnings. The totals are considered to be too small to make any significant changes.

#### 4.) Accumulation of Type Personnel by Categories

An assumption was made, based upon personal experience, that the Administrative, Academic and Professional Staff all live in the same type communities. Consequently they were combined into a single category. Clerical people were combined into that category because of the date of payment rather than by the actual work performed. Such combinations may have caused an erroneous picture to result in Table 12.

#### 5.) Discarding of Unidentifiable Data

A substantial amount of data could not be positively identified with a particular town. For example there were a substantial number of "no address" in the payrolls. All such data was discarded rather than redistributed in accordance with the percentage of known data. The assumption was made that there would be no or only an insignificant change by the redistribution.

This writer accepts the complete responsibility of any errors that may have been made. All participants were most cooperative in pointing out possible pitfalls in the use of the data to obtain the information on the impact of M.I.T. on the area.

6.) Questionnaires to the M.I.T. Family

Questionnaires were distributed to approximately 10% of the M.I.T. family.

Answers received as indicated in Table below:

Distributed to	Students	Staff and Faculty	Employees
Number	694	111	575
% of SMSA Residents	100	100	125

Answers Received

Number from SMSA Residents	303	51	143
% of Answers Received	44	46	25

The majority of possible sources of errors stems from the different interpretations possible by the recipient and this writer. For example, meals, personal services, and other purchases can be totalled in various combinations. Summation methods for the individual items may have caused incorrect totals to result. This writer used the averages obtained as well as discarding obviously incorrect atypical answers. The results are therefore considered satisfactory for this study.

This writer accepts the complete responsibility of any errors that may have been made. All participants were most cooperative in pointing out possible pitfalls in the use of the data to obtain the information on the impact of M.I.T. on the area.

THESIS INFORMATION

City Planning Department  
Room 7-333 M.I.T.

Dear Fellow Student:

I need your assistance and a few minutes of your time in order to complete my thesis on The Economic Impact of M.I.T. on Cambridge and Metropolitan Boston.

The requirement is to ascertain how and where the M.I.T. family spends its money so that the data can be expanded and combined with other information to measure the economic impact.

To gather the data I am asking you, as part of a random sample of students, staff, and faculty, to answer the questions on the attached sheets.

I would greatly appreciate the completion of the questionnaire as soon as possible. Please staple or tape closed, and return to me through any Institute mail box. Do not sign your name.

Thanks a million.

Sincerely, 

I. W. Finberg  
Course IV B

THESIS INFORMATION

INSTRUCTIONS

1. Circle applicable answers.
2. Fill in spaces only where applicable.
3. Note that expenditures are requested for two locations. If applicable use both columns by estimating the amount that pertains to each.
4. Give expenditures to nearest round figure.
5. Be careful to answer for the time period requested. Questions asked are on a monthly or annual basis.
6. Please answer promptly.
7. DO NOT sign your name.
8. Fold and staple or tape closed to show return address.
9. Return through any Institute mail box.

Many thanks.

I.W.F.

1. SEX

Male \_\_\_\_\_

Female \_\_\_\_\_

2. M.I.T. CLASS

Frosh    Soph    Junior    Senior    Graduate Student

3. LOCATION OF SCHOOL RESIDENCE

a. Cambridge                      b. Boston, Allston or Brighton

c. Other    Name town \_\_\_\_\_.

4. TYPE OF RESIDENCE

Dormitory                      Name Dormitory \_\_\_\_\_

Fraternity House

Private Room

Apartment                      furnished                      unfurnished

5. TYPICAL MONTHLY EXPENDITURES

TYPE	CAMBRIDGE	ELSEWHERE BOSTON AREA
------	-----------	-----------------------

a. RENT	\$ _____	\$ _____
---------	----------	----------

b. UTILITIES gas, electric	\$ _____	\$ _____
----------------------------	----------	----------

c. MEALS, RESTAURENT TYPE

COMMONS	\$ _____	\$ _____
---------	----------	----------

FRATERNITY HOUSE	\$ _____	\$ _____
------------------	----------	----------

OTHER PLACES	\$ _____	\$ _____
--------------	----------	----------

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 THESIS INFORMATION

5. TYPICAL MONTHLY EXPENDITURES (Continued)

d.	PERSONAL SERVICES (barber, beauty shop, cosmetics, toiletries, etc.)	\$ _____	\$ _____
e.	LAUNDRY & DRY CLEANING		
	LAUNDROMAT	\$ _____	\$ _____
	REGULAR SERVICE	\$ _____	\$ _____
f.	NEWSPAPERS & MAGAZINES	\$ _____	\$ _____
g.	NON-SCHOOL BOOKS	\$ _____	\$ _____
h.	TRANSPORTATION		
	M.T.A.	\$ _____	\$ _____
	AUTO (gas and oil)	\$ _____	\$ _____
	OTHER (bus, R.R., Air)	\$ _____	\$ _____
i.	SHOE REPAIR	\$ _____	\$ _____
j.	TAILORING REPAIRS	\$ _____	\$ _____
k.	SMOKING	\$ _____	\$ _____
l.	RECREATION (all types)	\$ _____	\$ _____
m.	BEVERAGES, ALCOHOLIC	\$ _____	\$ _____
n.	NON-RESTAURANT FOOD AND BEVERAGES (snacks, vending machines, home prepared)	\$ _____	\$ _____
o.	TELEPHONE		
	LOCAL	\$ _____	\$ _____
	LONG DISTANCE	\$ _____	\$ _____

6. TYPICAL ANNUAL EXPENDITURES  
 (School year except where indicated)

a.	TEXT BOOKS & SCHOOL SUPPLIES	\$ _____	\$ _____
b.	ADULTS CLOTHING AND ACCESSORIES	\$ _____	\$ _____
c.	FURNITURE & HOUSEHOLD APPLIANCES	\$ _____	\$ _____
d.	APPLIANCE SERVICING	\$ _____	\$ _____
e.	MEDICAL & DENTAL (Less insurance)	\$ _____	\$ _____
f.	INSURANCE (CALENDAR YEAR)		
	LIFE	\$ _____	\$ _____
	MEDICAL AND HOSPITAL	\$ _____	\$ _____
	AUTO	\$ _____	\$ _____
	OTHER (ACCIDENT, THEFT, etc.)	\$ _____	\$ _____



THESIS INFORMATION

6. TYPICAL ANNUAL EXPENDITURES (Continued)

g. AUTO SERVICING & MAINTENANCE  
(repairs, grease, garage) \$ \_\_\_\_\_ \$ \_\_\_\_\_

h. PROFESSIONAL SERVICES  
(Not medical or dental) \$ \_\_\_\_\_ \$ \_\_\_\_\_

7. MISCELLANEOUS INFORMATION

a. DURABLE GOODS. Circle item you own. List purchase price (round figure) under Cambridge, etc. if purchased locally; otherwise omit price.

BICYCLE \$ \_\_\_\_\_ \$ \_\_\_\_\_

SCOOTER OR MOTORCYCLE \$ \_\_\_\_\_ \$ \_\_\_\_\_

AUTO \$ \_\_\_\_\_ \$ \_\_\_\_\_

RADIO &/or RECORD PLAYER \$ \_\_\_\_\_ \$ \_\_\_\_\_

T.V. \$ \_\_\_\_\_ \$ \_\_\_\_\_

CAMERA \$ \_\_\_\_\_ \$ \_\_\_\_\_

TYPEWRITER \$ \_\_\_\_\_ \$ \_\_\_\_\_

b. BANK ACCOUNTS  
SAVINGS ACT. MAINTAINED IN \$ \_\_\_\_\_ \$ \_\_\_\_\_

CHECKING ACT. MAINTAINED IN \$ \_\_\_\_\_ \$ \_\_\_\_\_

c. VISITORS  
Estimate number of visitors you have ANNUALLY by visitor-days. Show figure under column where they normally stay.

d. CONTRIBUTIONS MONTHLY  
MONETARY  
To Churches \$ \_\_\_\_\_ \$ \_\_\_\_\_  
To other Charitable Organizations \$ \_\_\_\_\_ \$ \_\_\_\_\_

SERVICES, HOURS DONATED  
To Churches \_\_\_\_\_ hours \_\_\_\_\_ hours  
To Other Organizations \_\_\_\_\_ hours \_\_\_\_\_ hours

8. SUPPLEMENTARY QUESTIONS FOR MARRIED STUDENTS ONLY.

a. NUMBER OF CHILDREN \_\_\_\_\_

b. NUMBER IN SCHOOL \_\_\_\_\_

c. EXPENDITURES ON ANNUAL BASIS ON CHILDREN

1. Clothing \$ \_\_\_\_\_ \$ \_\_\_\_\_

2. Special schools such as dancing, music, etc. \$ \_\_\_\_\_ \$ \_\_\_\_\_

3. Toys & Recreations \$ \_\_\_\_\_ \$ \_\_\_\_\_

d. WIFE EMPLOYED IN: \_\_\_\_\_  
Type of Work \_\_\_\_\_

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THESIS INFORMATION

City Planning Department  
Room 7-333 M.I.T.  
April 30, 1964

Dear Staff or Faculty Member:

There have been a great number and variety of surveys made at M.I.T. in recent years, but none have gathered data on how and where the M.I.T. family spends its money. Consequently we really do not know as much as we would like about the economic impact of M.I.T. on Cambridge or on Metropolitan Boston. To help close the gap I selected that topic for my master's thesis.

The attached questionnaire will furnish the data for an important part of the study. It is being sent to you as part of a random sample of the Staff and Faculty.

The minutes spent to complete the questionnaire will be greatly appreciated. I'm sure the results of the study will also benefit the Institute.

Sincerely yours,  
A

I. W. Finberg

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THESIS INFORMATION

INSTRUCTIONS

1. Circle applicable answers.
2. Fill in spaces only where applicable.
3. Note that expenditures are requested for two locations. If applicable use both columns by estimating the amount that pertains to each.
4. Estimate expenditures to nearest round figure.
5. Be careful to answer for the time period requested. Questions asked are on a monthly or annual basis.
6. Please answer promptly.
7. DO NOT sign your name.
8. Fold, and staple or tape closed to show return address.
9. Return through any Institute mail box.

Many Thanks,  
 I.W.F.

1. SEX:        Male        Female

2. MARITAL STATUS  
 Single       Married       Number of Children \_\_\_\_\_ Number in School \_\_\_\_\_

3. LOCATION OF RESIDENCE  
 a. Cambridge       b. Boston, Allston or Brighton  
 c. Other. Please state town \_\_\_\_\_

4. TYPE OF RESIDENCE  
     House        Owned        Rented        Furnished        Unfurnished  
     Apartment                             Furnished        Unfurnished

5. TYPICAL MONTHLY EXPENDITURES (FOR ENTIRE FAMILY)

TYPE	CAMBRIDGE	ELSEWHERE, BOSTON AREA
a. RENT	\$ _____	\$ _____
b. UTILITIES (gas & electric)	\$ _____	\$ _____
Heating expense	\$ _____	\$ _____
c. MEALS, RESTAURANT TYPE		
On Campus	\$ _____	
Commercial Restaurants	\$ _____	\$ _____
d. PERSONAL SERVICES (barber, beauty shop, cosmetics, toiletries, etc.)	\$ _____	\$ _____
e. LAUNDRY & DRY CLEANING		
Laundromat	\$ _____	\$ _____
Regular Service	\$ _____	\$ _____

5. TYPICAL MONTHLY EXPENDITURES (FOR ENTIRE FAMILY) CONTINUED

	CAMBRIDGE	ELSEWHERE, BOSTON AREA
f. NEWSPAPERS & MAGAZINES	\$ _____	\$ _____
g. BOOKS ALL TYPES	\$ _____	\$ _____
h. TRANSPORTATION		
M.T.A.	\$ _____	\$ _____
Auto (gas and oil)	\$ _____	\$ _____
Other		
Bus	\$ _____	\$ _____
R.R.	\$ _____	\$ _____
Air	\$ _____	\$ _____
Taxi	\$ _____	\$ _____
i. SHOE REPAIR	\$ _____	\$ _____
j. TAILORING REPAIRS	\$ _____	\$ _____
k. SMOKING	\$ _____	\$ _____
l. RECREATION & AMUSEMENT	\$ _____	\$ _____
m. BEVERAGES, ALCOHOLIC	\$ _____	\$ _____
n. FOOD, BEVERAGES, PREPARED AT HOME	\$ _____	\$ _____
o. MAID OR HOUSECLEANING SERVICE	\$ _____	\$ _____
p. TELEPHONE		
Local	\$ _____	\$ _____
Long Distance	\$ _____	\$ _____
q. CONTRIBUTIONS		
Monetary		
To Churches	\$ _____	\$ _____
To Other Charitable Organizations	\$ _____	\$ _____
Donated Service Hours		
To Churches	_____ hours	_____ hours
To Other Organizations	_____ hours	_____ hours

6. TYPICAL ANNUAL EXPENDITURES FOR ENTIRE FAMILY  
 (USE PAST YEAR AS TYPICAL)

a. CLOTHING & ACCESSORIES		
Adults	\$ _____	\$ _____
Children	\$ _____	\$ _____
b. FURNITURE & HOUSEHOLD APPLIANCES	\$ _____	\$ _____
c. APPLIANCE SERVICING	\$ _____	\$ _____

6. TYPICAL ANNUAL EXPENDITURES FOR ENTIRE FAMILY (CONTINUED)

	CAMBRIDGE	ELSEWHERE, BOSTON AREA
d. MEDICAL & DENTAL	\$ _____	\$ _____
e. INSURANCE		
Life	\$ _____	\$ _____
Medical & Hospital	\$ _____	\$ _____
Auto	\$ _____	\$ _____
Other (Accident, Theft etc)	\$ _____	\$ _____
f. PETS	\$ _____	\$ _____
g. AUTO SERVICING, MAINTENANCE (Repairs, grease, garage)		
First Car	\$ _____	\$ _____
Second Car	\$ _____	\$ _____
h. PROFESSIONAL SERVICES (Not medical or dental)	\$ _____	\$ _____
i. REAL ESTATE TAXES	\$ _____	\$ _____
j. WATER & SEWAGE TAXES	\$ _____	\$ _____

7. MISCELLANEOUS INFORMATION

a. Bank Accounts		
Savings act. maintained in _____	_____	_____
Checking act. maintained in _____	_____	_____
b. VISITORS		
Estimate number of personal visitors you have ANNUALLY by visitor-days. Show figure under column where they normally stay.		
c. MAJOR PURCHASES DURING PAST 12 MONTHS (To nearest \$100.)		
Autos, Number _____	\$ _____	\$ _____
Real Estate	\$ _____	\$ _____
Other, please name type		
_____	\$ _____	\$ _____
_____	\$ _____	\$ _____
_____	\$ _____	\$ _____
d. CHILDREN'S SCHOOLING		
Number in Public School _____		
Number in Private Sch. _____	\$ _____	\$ _____
Supplementary School		
Dancing	\$ _____	\$ _____
Music	\$ _____	\$ _____
Other	\$ _____	\$ _____
e. NUMBER OF FIRMS FOR WHICH YOU (HEAD OF HOUSEHOLD) WORK OR IN WHICH YOU HAVE A FINANCIAL INTEREST.		
	No. _____	No. _____

THESIS INFORMATION

City Planning Department  
Room 7-333 M.I.T.  
April 30, 1964

Dear Fellow Member of the M.I.T. Family:

I need your assistance and a few minutes of your time in order to complete my thesis on The Economic Impact of M.I.T. on Cambridge and Metropolitan Boston.

The requirement is to ascertain how and where the M.I.T. family spends its money so that the data can be expanded and combined with other information to measure the economic impact.

To gather the data I am asking you, as part of a random sample of students, staff and faculty, to answer the questions on the attached sheets.

I would greatly appreciate the completion of the questionnaire as soon as possible. Please staple or tape closed, and return to me through any Institute mail box. Do not sign your name.

Thanks a million.

∩ Sincerely,

Irving<sup>1</sup> W. Finberg  
Course IV B

∩

THESIS INFORMATION



THESIS INFORMATION

5. TYPICAL MONTHLY EXPENDITURES (continued)

	CAMBRIDGE	ELSEWHERE, BOSTON AREA
e. LAUNDRY & DRY CLEANING		
Laundromat	\$ _____	\$ _____
Regular Service	\$ _____	\$ _____
F. NEWSPAPERS & MAGAZINES	\$ _____	\$ _____
g. BOOKS ALL TYPES	\$ _____	\$ _____
h. TRANSPORTATION		
M.T.A.	\$ _____	\$ _____
Auto (gas and oil)	\$ _____	\$ _____
Other		
Bus	\$ _____	\$ _____
R.R.	\$ _____	\$ _____
Air	\$ _____	\$ _____
Taxi	\$ _____	\$ _____
i. SHOE REPAIR	\$ _____	\$ _____
j. TAILORING REPAIRS	\$ _____	\$ _____
k. SMOKING	\$ _____	\$ _____
l. RECREATION & AMUSEMENT	\$ _____	\$ _____
m. BEVERAGES, ALCOHOLIC	\$ _____	\$ _____
n. FOOD, BEVERAGES, PREPARED AT HOME	\$ _____	\$ _____
o. TELEPHONE		
Local	\$ _____	\$ _____
Long Distance	\$ _____	\$ _____
p. CONTRIBUTIONS		
Monetary		
To Churches	\$ _____	\$ _____
To Other Charitable Organizations	\$ _____	\$ _____
Donated Service Hours to Churches	_____ hours	_____ hours
To Other Organizations	_____ hours	_____ hours

6. TYPICAL ANNUAL EXPENDITURES FOR ENTIRE FAMILY IF YOU ARE THE HEAD OF THE HOUSEHOLD. IF NOT USE YOUR OWN EXPENSES ONLY. (USE PAST YEAR AS TYPICAL).

a. CLOTHING & ACCESSORIES		
Adults	\$ _____	\$ _____
Children	\$ _____	\$ _____
b. FURNITURE & HOUSEHOLD APPLIANCES	\$ _____	\$ _____
c. APPLIANCE SERVICING	\$ _____	\$ _____
d. MEDICAL & DENTAL	\$ _____	\$ _____



THESIS INFORMATION

6. TYPICAL ANNUAL EXPENDITURES (Continued)

	CAMBRIDGE	ELSEWHERE, BOSTON AREA
e. INSURANCE		
Life	\$ _____	\$ _____
Medical & Hospital	\$ _____	\$ _____
Auto	\$ _____	\$ _____
Other (Accident, Theft, etc.)	\$ _____	\$ _____
f. PETS	\$ _____	\$ _____
g. AUTO SERVICING, MAINTENANCE (Repairs, grease, garage)	\$ _____	\$ _____
h. PROFESSIONAL SERVICES (Not medical or dental)	\$ _____	\$ _____
i. REAL ESTATE TAXES	\$ _____	\$ _____
j. WATER & SEWAGE TAXES	\$ _____	\$ _____

7. MISCELLANEOUS INFORMATION

a. Bank Accounts		
Savings act. maintained in	_____	_____
Checking act. maintained in	_____	_____

b. MAJOR PURCHASES DURING PAST 12 MONTHS (TO NEAREST \$100.)

AUTOS	\$ _____	\$ _____
REAL ESTATE	\$ _____	\$ _____
OTHER, PLEASE NAME TYPE		
_____	\$ _____	\$ _____
_____	\$ _____	\$ _____
_____	\$ _____	\$ _____

c. CHILDRENS SCHOOLING

    Number in Public School \_\_\_\_\_

    Supplementary School

Dancing	\$ _____	\$ _____
Music	\$ _____	\$ _____
Other	\$ _____	\$ _____

d. TYPE WORK AT MIT \_\_\_\_\_

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