Maryland Incubator Impact Analysis and Evaluation of Additional Incubator Capacity

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Executive Summary

The objective of business incubation is to encourage, promote, stimulate, and support research and development (R&D) activity through the use of different investments leading to commercialization of new products and services by small businesses. Business incubators can provide significant benefits by helping to create successful businesses that generate wealth and job opportunities to their regions and states. It is important to assess the economic impacts of incubators to understand their outcomes and provide support for increased activities. It provides decision makers with a better understanding of the state's capacity for incubators and the potential to realize further economic development outcomes from increased investment in incubation.

During the period of April to September 2007, Maryland Technology Development Corporation (TEDCO) commissioned RTI International to perform an economic impact assessment of Maryland's technology incubators and analyze the state's capacity for additional technology-based technology incubators. RTI also investigated barriers faced by incubator-graduate companies and researched effective policies to mitigate these barriers.

Maryland currently has 19 technology incubators that were included in this report,[1] as well as 4 proposed incubator projects. Current clients and graduates of these incubators felt, on average, that their incubator experience was very important to their companies, giving it a rating of 3.1–3.2 on a scale of 0 (not at all important) to 4 (extremely important). While both current clients and graduates rated the majority of incubator services as very important, the most important service provided by the incubators for both groups of respondents was affordable, functional space.

The economic impact analysis measures the total impact of Maryland's technology incubators using a regional macroeconomic impact model called IMPLAN. Survey data show that incubator firms employed 5,374 employees in 2006 and indirectly added another 8,670 jobs through economic interactions with other Maryland industries and households. They also generated approximately $1.2 billion in gross state product and $100 million in state and local taxes. RTI also used an exploratory econometric analysis to evaluate the impact estimates coming from the IMPLAN model. This analysis confirmed that the IMPLAN results were within the reasonable range suggested by historical relationships between incubator establishment and economic activity. The analysis also shows that graduates and incubator tenants are associated with industries

[1] One of these incubators, The University of Maryland – Baltimore, was under construction during the most of this research period. Therefore, the incubator is not captured in the survey or interview findings.

that generate a greater number of indirect economic benefits than do other industries in the Maryland economy.

To assess the relationships between TEDCO incubator funding and economic impact analysis, RTI examined a single-year funding (FY2006) and compared it economic data from the regional impact model. This analysis showed that for every $1 of incubator assistance funding provided by TEDCO, tenant companies contributed $1,800 dollars to Maryland's gross state product in 2006.[2] In addition, TEDCO made an average investment of $120 per incubator company job in 2006.[3]

RTI's analysis also found that Maryland has the potential to support additional high-tech incubators. While the findings from the data analysis, client surveys, and interviews do not constitute a feasibility study for new high-tech incubators in Maryland, these findings are useful to supplement the established and effective feasibility study process that TEDCO has in place for potential new technology incubators. Maryland has a strong technology economy, a wealth of research centers and technology generators, a strong concentration of high-tech employment, and exceptional political support for incubation, suggesting a solid foundation for additional technology incubators in the state.

However, the state's capacity for niche incubators in regenerative medicine and alternative energy is not as clear. While providing a definitive answer on whether Maryland can or should invest in niche incubators is beyond the scope of this report, it is possible to comment on the circumstances in which such an incubator would exist. While the state has supported programs and initiatives in these industries, there is not a strong concentration of either of these industries in the state. More importantly, interviews with incubator managers and stakeholders, who collectively constitute a vast pool of knowledge concerning technology incubators, revealed widespread skepticism toward the idea of niche incubators in any industry, not just those investigated in this report. On the other hand, an alternative proposal to establish focus areas in these industries within other technology incubators has stronger potential for success and acceptance.

Assisting incubator companies once they graduate is another important issue to consider. Post-incubator assistance could potentially help companies remain successful and further contribute to Maryland's economy as the businesses grow over time. Survey and interview findings indicate that locating suitable space is the most pressing issue for graduate companies, especially those in the life sciences. This concern could be

[2] Approximately half of this value ($900) is directly associated with tenant companies, and the remaining $900 was generated through indirect impacts from the tenant companies' economic links with other Maryland industries and households.

[3] A similar analysis could not be performed for graduate companies because of data limitations, but the tenant estimates provide the best available measure for new successful graduate firms. It is important to note that since this measure is restricted to a single year, it could understate funding/impact relationships for mature graduate firms that experience sales and employment growth over time. This figure includes only direct jobs within incubator client companies.

addressed through the creation of business accelerators that include wet lab space or through the establishment of grant funds or loan programs to assist companies in customizing their own space after graduation from the incubator.

Overall, the survey and interview results indicated that incubator clients and stakeholders were very pleased with TEDCO's services. Most thought it important for TEDCO to continue its existing operations with its current high level of efficiency and effectiveness, and any additional programs should be structured so as not to reduce its ability to execute current programs.

The key results and findings are summarized below.

- In 2006, the technology incubators in Maryland increased gross state product by $1.2 billion.
- The total annual employment impact of technology incubators in Maryland in 2006 is 14,044 new full-time employees in the state.
- The technology incubators in the state increased state and local tax revenue in 2006 by approximately $104 million per year.
- Tenants and graduates of the technology incubators have found their incubator experiences to be very important to their companies, giving them an average rating of 3.1–3.2 on a scale of 0 (not at all important) to 4 (extremely important).
- Maryland has the potential to support new high-tech incubators, as evidenced by the state's strong high-tech economy, abundant research, concentration in high-tech employment, and exceptional political support.
- Maryland's potential for new niche incubators in regenerative medicine and alternative energy is not clear, as a variety of conflicting factors are at play in the state. However, there is greater support for creating focus areas in these industries within other technology incubators.
- The state can assist incubator graduates, especially those in the life sciences, by creating business accelerators and/or establishing grant or loan programs to assist companies in customizing their own post-incubator space.

Key Data Points Resulting From the Impact Analysis:

Incubator Firms in 2006:

- Employed 14,044 employees in the state (5,374 direct employees and 8,670 indirect employees)
- These jobs contributed $845 million in annual salary and benefits to Maryland households
- Gross state product contributions totaled $1.2 billion

- Increased state output by $2.7 billion per year
- Contributed $104 million in state and local taxes.

TEDCO[4]:

- For every $1 of incubator assistance funding provided by TEDCO tenant companies contributed $1,800 dollars to Maryland's gross state product.
- TEDCO made an average investment of $120 per incubator company job in 2006.

Incubators in Maryland:

- 18 technology incubators in operation comprising 453,061 square feet
- 4 proposed technology incubators

Future Implications:

- Maryland has a strong high-tech industry, with over 15,000 establishments employing almost 200,000 in 2006. The average annual pay for high-tech jobs is $75,000, more than 60% higher than the statewide average annual wage of $46,000.
- The high-tech industry in Maryland overall has a location quotient of 1.54, indicating that employment in high-tech industries is more highly concentrated than in the nation. (An LQ between 0.75 and 1.25 is interpreted to mean that employment is the similar to the national average. An LQ above 1.25 indicates concentration).
- The three most concentrated industries are management, scientific, and technical consulting services (LQ = 3.01); computer systems design and related services (LQ = 2.33); and communications equipment manufacturing (LQ = 2.06).
- Academic R&D totaled $2,357 million in 2005. This is fourth highest in the nation and surpasses North Carolina, Massachusetts, and Virginia.
- There are over 40 research centers in Maryland, including a significant presence of federal labs and prominent university institutes.
- Taken together, these facts provide the state with a strong foundation for additional technology incubator growth.

This Study:

- 359 incubator clients and graduates from 18 incubators supported by TEDCO were surveyed.
- The survey had an overall response rate of 45%.

[4] See footnotes on Page 2.

1. Introduction

1.1 Report Scope and Objectives

In March 2007, the Maryland Technology Development Corporation (TEDCO) retained RTI International to conduct a comprehensive study of the technology incubators TEDCO funds in the state of Maryland.[5] The study had three significant objectives. First, RTI would conduct an economic impact analysis of the technology incubators on Maryland's economy (covered in Section 2). The results of this impact analysis measure the direct economic impacts of incubator and graduate firms and identify any additional economic spillover effects generated by inter-industry transactions and household income changes. The second objective of this study was to analyze the state's capacity for new technology incubators (Section 3). This analysis provides a foundation to supplement TEDCO's existing policy of requiring feasibility studies to be conducted for the incubators it funds. The final objective of this study was to examine the needs of incubator graduates and ways to help these graduate companies continue to be successful after leaving the incubators (Section 4).

1.2 Technology Incubators in Maryland

One of TEDCO's primary focus areas is its business incubator assistance program, which promotes the growth of technology companies in Maryland through support of business incubators. The state's incubator network is also strengthened by the Maryland Business Incubation Association (MBIA), an association of business incubators dedicated to sharing resources, information, and best practices to promote business incubation excellence in Maryland. Both TEDCO and MBIA have been instrumental in building the incubation network in Maryland to become the most comprehensive and cohesive in the country.

Eighteen Maryland technology incubators and seven proposed incubator projects were included in this report. The majority of these incubators are located in Baltimore, Montgomery, Howard, and Prince George's counties. Technology incubators can also be found in other areas of the state, including Frederick, Anne Arundel, Allegany, Garrett, and Washington counties.

The technology incubators in Maryland significantly benefit the state by helping to create successful businesses that generate wealth and job opportunities for their regions and state. Indeed, Maryland jobs in high-tech industries pay, on average, over 60% more than

[5] This study included only the technology incubators in Maryland chosen by TEDCO for inclusion. Other incubators in the state were not included because they were not technology incubators or were not chosen by TEDCO.

the state's average annual wage. Small businesses are also important to the health of the state's economy, contributing close to half of all payroll and receipts for Maryland.

Clearly, high-tech incubators are contributing to the health of Maryland's technology economy. This report quantifies this contribution, analyzes the potential for increasing it through additional technology incubators, and explores ways that the state can support post-incubator technology companies to preserve and expand this economic contribution in the future.

1.3 Comparison to Previous Impact Analysis

TEDCO previously commissioned an economic impact analysis for technology incubators in 2000-2001. The 2000-2001 study focused primarily on conducting an economic impact analysis and also attempted to measure the value of incubator services.[6] It did not include the capacity analysis and research into incubator graduate assistance performed in this study; hence, no comparisons can be made in those areas.

The technology incubator landscape in Maryland has changed significantly since the 2000-2001 study was conducted. The most striking difference is the sheer size of the technology incubator network. In 2000, the impact analysis included 125 tenants and graduates at 6 incubators. The current study, in contrast, surveyed 359 clients at 18 technology incubators. The threefold growth in the incubator network in less than seven years has created a very different environment in which the present study was conducted.

Although the previous economic analysis uses IMPLAN, it does not provide sufficient detail on how final demand changes were introduced into the IMPLAN model and does not report the type of multiplier used to describe the response of the economy to a change in demand.[7] Without this information, only limited comparisons between the two studies can be made.

For example, the original study suggests total employment for tenants and graduates was approximately 2,900 to 3,700 employees in 2000 compared to the 5,374 employees in 2006. This employment growth will lead to higher economic impact estimates. In addition, our review of the economic multipliers suggests differences between the values in the two studies; this study's multipliers are generally higher than the previous study. These differences can occur for a variety of reasons (e.g., different IMPLAN data years [2000 vs. 2004], different multipliers, and different approaches to mapping survey data to IMPLAN industries). For this study, we have included these details to allow stakeholders and researchers to more fully interpret the model results and allow better comparisons with future studies.

[6] Valuation of incubator services was not included as part of the scope of work for this study.

[7] IMPLAN contains three multipliers: Type I, Type II, and Type SAM. This report uses the Type SAM multiplier.

1.4 Methodological Approach

This report involved a multi-pronged methodology. Extensive secondary research into qualitative aspects of Maryland's high-tech economy as well as collection of quantitative data on the state's economy were two important methods. Literature reviews were also conducted to inform the research into incubator graduate assistance.

Perhaps the most comprehensive method used in this study was the primary research conducted through an Internet-based incubator client survey. The survey was distributed to 359 current and graduate incubator clients. Survey responses were provided by 161 clients, for an overall response rate of 45%. About 63% of these responses were from current clients, another 20% came from graduates, and the remaining 17% of respondents did not specify whether they were current clients or graduates. The survey collected quantitative company information as well as qualitative data from respondents. Tables containing all qualitative information collected through the survey can be found in **Attachment D**. The survey was Internet-based to allow for customization of questions based on specific responses and therefore cannot be displayed here as it appeared to respondents; however, a copy of the survey, including all possible questions, can be found in **Attachment J**.

Survey results as well as secondary data collection contributed to the next methodology, the economic impact analysis. This analysis included two parts: a regional macroeconomic input-output model called IMPLAN and an exploratory econometric analysis that evaluates the impact estimates coming from the IMPLAN model. This provides some empirical basis for assessing whether model results are consistent with observed historical relationships between incubator establishment and local economic activity.

Finally, our methodology employed numerous interviews and focus groups with incubator clients, managers, and other stakeholders. A list of interviewees can be found in **Attachment D**, and interview protocols are included in **Attachment F**. These interviews revealed themes and additional information that helped contextualize our findings.

Two analytical elements not included in this study were direct comparisons with other state investments in technology incubators and statewide impact assessments of technology incubator programs. Incubators and incubator programs on the state level are financed in variety of ways, such as direct funding to an institution like TEDCO or individually through an associated state university or economic development organization. Pulling together these financing streams from state budgets is a complex process and deemed outside of the scope of this study. Similarly, incubators are assessed in a variety of ways. Most often impact assessments are conducted for larger individual incubators. Through our research, we found that other states do not coordinate their

incubator programs in the same fashion as Maryland, and thus direct comparisons are not meaningful or useful for decision making.

More detail on specific methodologies will be included in relevant report sections.

1.5 Report Overview

This report is divided into four primary sections, starting with Section 2.

Section 2: Economic Impact Analysis

This section uses data collected from the survey in an economic input-output model (IMPLAN) to estimate the total economic impacts of the Maryland technology incubators on key macroeconomic variables such as employment, income, and state and local taxes. It includes an employment and funding/revenue profile of firms responding to the survey, describes the direct and indirect economic relationships the IMPLAN model attempts to measure, reports the results of the IMPLAN simulation, and illustrates the relative influence of industries with incubator clients and graduates compared to other Maryland industries.

Section 3: State Capacity for New Technology Incubators

This section provides a description and analysis of factors related to Maryland's capacity for additional technology incubators. A snapshot of Maryland's high-tech economy is provided, as well as an overview of the state's current technology incubator landscape. An analysis of Maryland's potential for new high-tech incubators, as well as the potential for niche incubators focused on alternative energy and regenerative medicine, is also included in this section.

Section 4: Graduate Company Barriers and Policies for Addressing Barriers

This section employs a number of different methods for exploring barriers to graduate company success and ways to reduce these barriers. This is discussed through a brief literature review, description of approaches for assisting incubator graduates, specific findings for Maryland from interviews and survey results, and suggested options for TEDCO to pursue to assist graduates and promote greater small technology business success overall.

Section 5: Summary of Findings and Implications for Maryland

This final section pulls together the conclusions and findings from the previous sections. Themes that consistently emerged in multiple research areas are discussed in the context of their larger implications for technology incubators and associated programs and policies in Maryland.

2. Economic Impact Analysis of Technology Incubators in Maryland

In this section, we use the RTI survey to provide a recent snapshot of tenant and graduate firms using employment and funding/revenue survey responses. We combine this data with survey data collected by MBIA and a regional economic model (IMPLAN) to estimate the total economic contributions of technology incubators in Maryland. These contributions are measured in terms of gross state product, salaries, jobs, and state and local taxes. We also demonstrate that technology incubators in Maryland are associated with high-tech sectors that generate significant impacts on the rest of the economy.

2.1 Employment and Revenue Profile of Tenant and Graduate Survey Respondents

As described in the introduction, RTI surveyed 359 incubator clients from June to July of 2007. Out of all firms surveyed, 161 responded for a response rate of 45% (100 tenants, 32 graduates, and 29 companies not identifying their current client status). In this section, we present an economic profile of the firms that responded to the survey. This profile includes descriptions of their employment and funding/revenue patterns as well as a description of the funding/revenue sources.

2.1.1 Firm Employment Patterns: 2005 to 2007

As shown in **Table 2-1**, graduate firms employed more than twice as many full-time-equivalent employees (FTEs) per firm as incubator tenants.[8] Both graduates and incubator tenant employment grew at similar rates between 2005 and 2007 (approximately 36% per year). Firms that did not identity their client status have similar employment levels as current incubator tenants. However, over the three-year time period, employment in these firms grew at a slower rate (21% per year).

[8] Nearly all respondents (98% or 157 companies) responded to this portion of the survey.

Table 2-1. Full-Time Equivalent (FTEs) Employees by Client Status and Year

	2005			2006			2007		
	Number of Companies	Total FTEs	Average Number of FTEs	Number of Companies	Total FTEs	Average Number of FTEs	Number of Companies	Total FTEs	Average Number of FTEs
Current tenants	100	385	4	100	525	5	100	720	7
Graduate	32	314	10	32	463	14	32	584	18
Unknown client status[a]	25	112	4	25	143	6	25	164	7
Total	157	810	5	157	1,131	7	157	1,467	9

[a] Survey respondents not identifying their current client status

2.1.2 Funding/Revenue Patterns: 2005 and 2006

As shown in **Table 2-2**, the average graduate firm reported receiving nearly five times more funding/revenue than did the average current incubator tenant, reflecting life-cycle patterns of successful graduate firms as they mature.[9] Graduate firms also account for the majority of funding revenue reported by survey respondents. As shown in **Figure 2-1**, graduate firms account for 60% of the $201 million in funding/revenue reported by survey respondents.

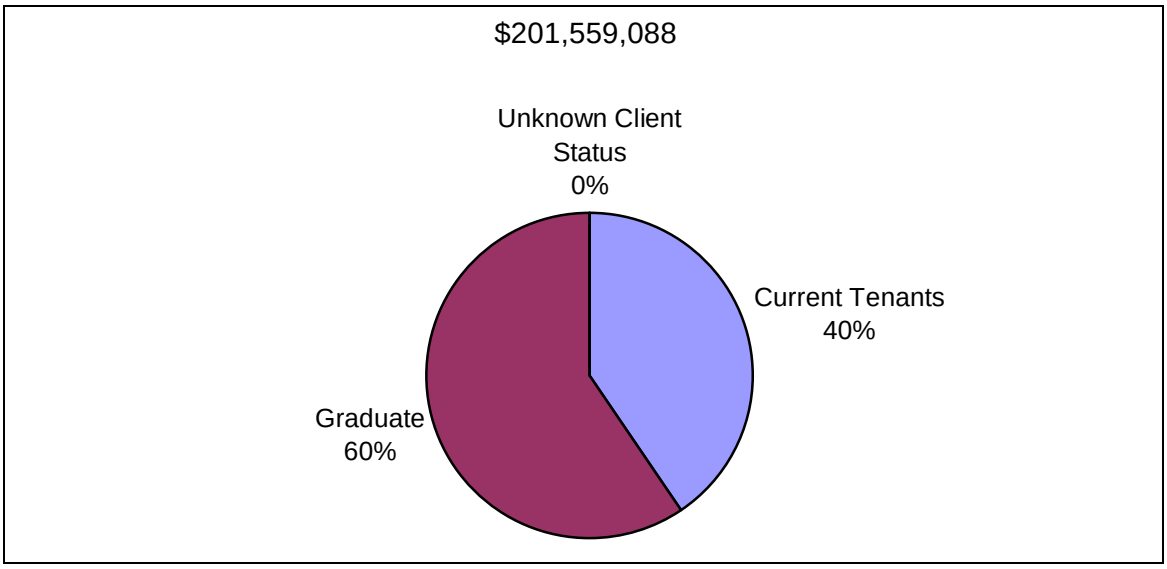
Table 2-2. Funding/Revenues by Client Status and Year

	2005			2006		
	Number of Companies	Annual Funding/ Revenues	Average Funding/ Revenues	Number of Companies	Annual Funding/ Revenues	Average Funding/ Revenues
Current tenants	99	$45,205,930	$456,626	99	$81,503,154	$823,264
Graduate	32	$74,129,140	$2,316,536	32	$120,040,934	$3,751,279
Unknown client status[a]	2	$15,000	$7,500	2	$15,000	$7,500
Total	133	$119,350,070	$897,369	133	$201,559,088	$1,515,482

[a] Survey respondents not identifying their current client status

[9] Firms with unknown client status received an average of only $7,500 per year in funding/revenue and saw no growth between 2005 and 2006.

Figure 2-1. Distribution of Funding/Revenues by Client Status



The source of funding/revenue received by incubator tenants and graduates is an important issue to consider when interpreting any regional economic impact analyses. In general, regional impact models provide better assessments when the vast majority of economic sources flow into the economy from external sources.[10] The survey shows that firms supported by technology incubators are attracting real economic resources to the state versus redistributing existing resources across different sectors of the state economy. Of the $201 million in funding/revenue reported by survey respondents for 2006, 85% was from federal, international, and other sources outside of the state of Maryland (see **Figure 2-2**).

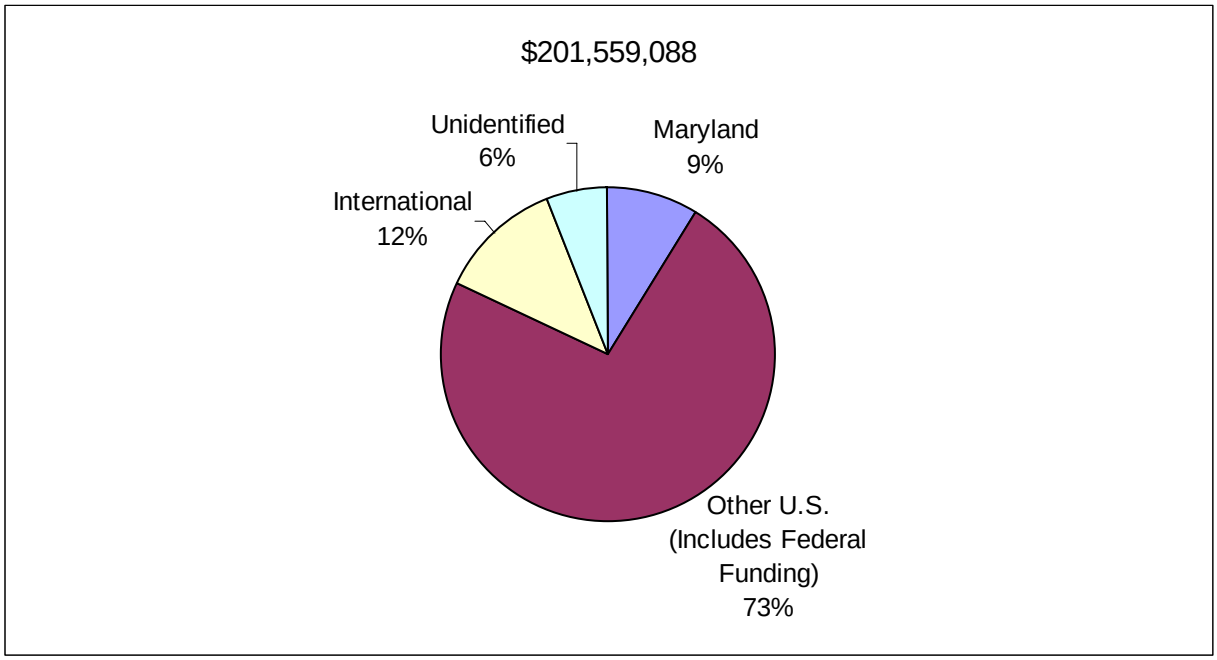
Table 2-3. Funding/Revenues by Source and Client Status: 2006

	Maryland	Other U.S. (Includes Federal Funding	International	Unidentified	Total
Current tenants	$10,733,591	$61,544,710	$6,390,839	$2,834,014	$81,503,154
Graduate	$7,087,381	$85,531,044	$18,763,945	$8,658,564	$120,040,934
Unknown client status[a]	$4,500	$10,500	$0	$0	$15,000
Total	$17,825,473	$147,086,253	$25,154,784	$11,492,578	$201,559,088

[a] Survey respondents not identifying their current client status

[10] In cases where resources instead came from institutions or households within Maryland, modeling economic impacts would become more complex because we would have to explicitly model changes in spending pattern by source. For example, if direct revenue increases in the survey were solely the result of Maryland household purchases, the analysis should account for offsetting economic impacts associated with Maryland residents spending less on other goods and services in the local economy. Measuring these substitution effects is difficult and often requires alternative modeling frameworks that are beyond the scope of this report.

Figure 2-2. Distribution of Funding/Revenues by Source: 2006



2.2 Analysis Methods

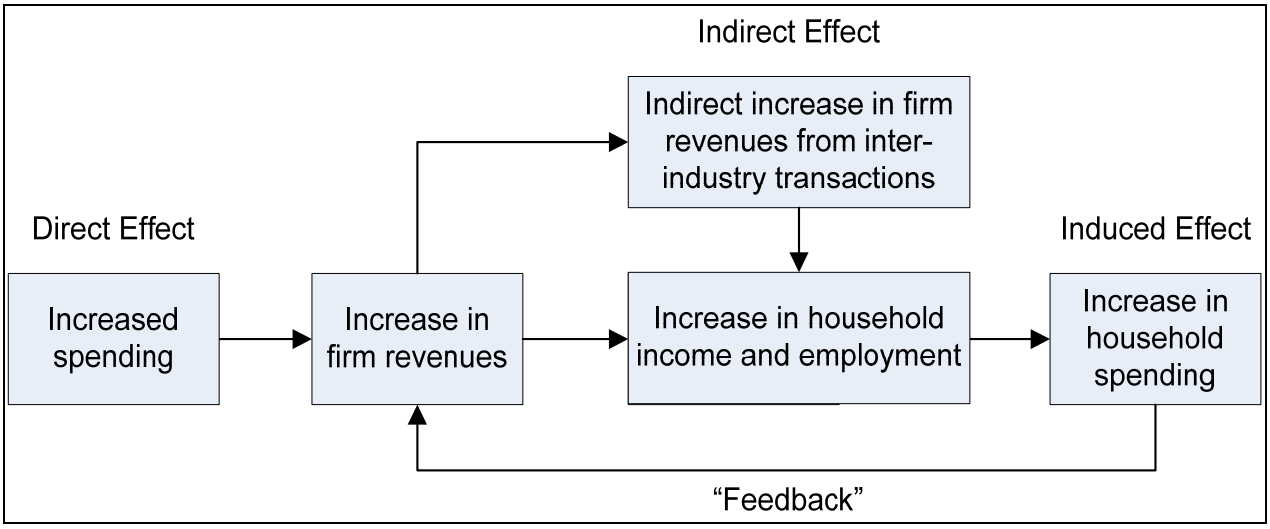
Technology incubators in Maryland provide a variety of resources and services that support innovative start-up companies. To measure the economic effects of these companies, RTI used a state-level input-output (I/O) model that simulates the total economic effects of these transactions. This approach has a long history and is well-known in the economic literature (Loveridge, 2004; Berck and Hoffman, 2002). The process generating the total economic effect is illustrated in **Figure 2-3** and includes

- **Direct Effects:** the immediate consequences in industries that experience new sales.
- **Indirect Effects**: responses in other industries to changes in the industries experiencing direct effects.
- **Induced Effects**: responses by households to the extra income received as the economy expands. Since additional wage payments will be received as the economy grows, households will purchase more goods and services, which will lead to greater expansion of the economy.

To understand these processes in the context of this study, consider the following example. Companies assisted by one of the technology incubators in Maryland experience "new demand" for their goods and services from outside the state (the "direct effect" of the incubator program). To meet this new demand, these companies will purchase more goods and services from other firms in the region, who will in turn

purchase more goods and services from other firms to meet their new sales (indirect effects). Finally, as new job opportunities created by the expanding economy lead to higher incomes, households themselves will purchase more goods and services leading to further expansion of the economy (these are the "induced effects of the firms assisted by incubators).[11] The total impact of incubator clients on the state economy will be the change in employment and output after all these effects have been taken into account.

Figure 2-3. Describing the Process That Generates a Program's Total Economic Effect



2.2.1 The IMPLAN State-Level Input-Output Model

The I/O model used by RTI for this analysis was the IMPLAN economic impact model. RTI selected this model because it is one of the most widely used I/O software models in economic development analysis. It has also been used in similar studies that measured the economic effects of business incubators supported by Maryland (RESI, 2001) and other incubator analysis (Markely and McNamara, 1994).

IMPLAN, like all I/O models, quantifies the indirect and induced effects associated with a change in final demand using mathematical representations of these linkages called "multipliers." IMPLAN includes five different sets of multipliers that correspond to five measures of regional economic activity: total industry output, personal income, total income, value added, and employment.

IMPLAN can construct these multipliers for 509 economic sectors for any state-defined region in the United States. The economic database that IMPLAN uses to construct these

[11] Indirect and induced impacts will continue indefinitely (creating secondary feedback loops), but will become smaller over time as a result of "leakages." For example, not every increase in household income is spent on goods and services (some is saved), and expenditures necessarily occur within the state economy.

multipliers is itself built from official government statistics (e.g., the National Income and Product Accounts [NIPA] published annually by the Bureau of Economic Analysis [BEA], the BEA I/O accounts for the United States, and numerous other data sources). These data are constructed to be internally consistent (i.e., county data sum to state totals and state data sum to national totals).

These multipliers can be used in several ways. First, they can be employed to derive estimates of the statewide changes in macroeconomic variables that a change of final demand in one sector will have on other sectors. Consider the following example using the employment, Type SAM multipliers[12] for major sectors in the state of Maryland, reported in **Table 2-4**. First, suppose that an increase in demand for durable goods occurs and leads firms in the Durable Goods Manufacturing sector to hire 100 new employees. Using the employment multiplier derived from IMPLAN, this increase would have a total employment effect, after indirect and induced effects have been taken into account, of 220 employees (100 x 2.2), which reflects an additional 120 jobs.

Table 2-4. Examples of IMPLAN Employment Multipliers for Maryland: 2004

Sector	Employment
Agriculture	1.7
Construction	1.8
Durable Goods Manufacturing	2.2
Nondurable Goods Manufacturing	2.9
Other Services	1.5
Professional Services	2.3
Retail Trade	1.4
Warehousing	1.5
Wholesale Trade	2.0
Transportation	2.2

A second way that multipliers can be used is to compare the relative influence an industry has in an economy. For example, a similar 100-employee increase in the agriculture

[12] The Type SAM multiplier computes induced effects using information from the underlying social accounting matrix. This accounts for social security and income tax leakages, institution savings, and commuting; and other inter-institutional transfers. For this analysis, RTI only included households, which is IMPLAN's default setting for Type SAM multipliers. We note the previous economic impact analysis performed for TEDCO (RESI, 2001) does not report the type of multiplier used for the analysis or variations in multipliers across industries. Without this information, it is difficult to compare and explain any differences in the multipliers between the two analyses.

sector leads to only 70 additional jobs; the total effect is 170 employees. Highlighting these differences can support and strengthen claims about the importance of a particular industry.

2.3 Analysis Results

In this section, we begin by briefly describing how job contributions were estimated for each industry using survey data. This estimate provides a measure of the initial economic effect of incubator tenant and graduate companies. Next, we present measures of the additional economic benefits that these jobs create throughout Maryland's economy. These additional benefits arise from inter-industry purchases and new household spending associated with the extra income earned as the Maryland economy expands.

After these measures of benefits have been presented, we describe an econometric analysis that was conducted to compare the size of the economic effects generated by IMPLAN with observed historical relationships between incubator establishment and economic activity. This analysis established that our estimates of the benefits generated by incubators in Maryland are consistent with historical evidence.

We conclude this section with a discussion of the individual industries most affected by incubators in Maryland. This discussion demonstrates that technology incubators in Maryland are associated with high-tech sectors that generate significant impacts on the rest of the economy

2.3.1 Incubator Tenants and Graduates Job Contributions by Industry: Measuring the Initial Jobs Effect

Using the IMPLAN model to identify the size of the direct economic contribution presents a variety of challenges, and the literature on these models suggests measurement errors can significantly influence conclusions. To address these concerns, RTI has carefully documented how we use the survey data to construct a measure of the direct job contributions for IMPLAN. We provide a brief overview of the method and results of this procedure below. Additional details associated with the calculations can be found in **Attachment I**. Other researchers should be able to use this data to replicate the analysis discussed in this section.

RTI identified the direct job contribution of incubator tenants and graduates using employment data identified in the comprehensive 2006 MBIA survey. Firms responding to this survey reported that they employed a total of 5,374 employees in 2006 (1,449 employed by current tenants and 3,925 individuals employed by graduates). To use the employment data for the IMPLAN analysis, we had to determine the IMPLAN sector to which each firm is assigned. This determination was made using information provided by

a sample of firms responding to the RTI survey (e.g., a description of each firm's operations as well as their 4-digit North American Industry Classification System [NAICS] codes). **Table 2-5** reports the results of this procedure—the estimated direct job contributions by IMPLAN sector. This data was used as the primary input in the economic model.

Table 2-5. Direct Impacts of the Incubator Firms on Maryland Economy: 2006

IMPLAN	IMPLAN Description	Employees
33	New residential 1—unit structures—all	8.3
46	Dog and cat food manufacturing	1.1
47	Other animal food manufacturing	4.4
60	Frozen food manufacturing	8.4
61	Fruit and vegetable canning and drying	8.1
160	Pharmaceutical and medicine manufacturing	35.9
171	Other miscellaneous chemical product manufacturing	≤0.1
302	Electronic computer manufacturing	8.3
305	Other computer peripheral equipment manufacturing	8.3
308	Other communications equipment manufacturing	2.8
313	Electromedical apparatus manufacturing	69.0
343	Miscellaneous electrical equipment manufacturing	5.5
381	Sporting and athletic goods manufacturing	5.5
389	Buttons, pins, and all other miscellaneous manufacturing	41.4
390	Wholesale trade	2.8
417	Software publishers	38.6
422	Telecommunications	35.9
423	Information services	165.5
424	Data processing services	179.3
439	Architectural and engineering services	44.1
440	Specialized design services	2.8
441	Custom computer programming services	169.1
442	Computer systems design services	67.1
443	Other computer-related services including facilities management	14.7
444	Management consulting service	95.0
445	Environmental and other technical consulting	16.8
446	Scientific research and development services	127.6
447	Advertising and related services	66.2
450	All other miscellaneous professional and technical services	69.0
451	Management of companies and enterprises	8.3
454	Employment services	8.3
463	Other educational services	82.8
468	Nursing and residential care facilities	4.1
493	Civic, social, professional, and similar organizations	2.8
506	Federal non-military	41.4
160	Pharmaceutical and medicine manufacturing	678.9
269	All other industrial machinery manufacturing	84.9
417	Software publishers	101.8
423	Information services	76.4
437	Legal services	≤0.1

IMPLAN	IMPLAN Description	Employees
439	Architectural and engineering services	135.8
441	Custom computer programming services	165.8
442	Computer systems design services	65.9
443	Other computer related services, including facilities management	14.4
444	Management consulting services	79.3
445	Environmental and other technical consulting services	14.0
446	Scientific research and development services	2,397.4
447	Advertising and related services	59.4
478	Other amusement, gambling, and recreation industries	50.9
Total		**5,374.0**

2.3.2 Technology Incubator Contributions to Maryland's Gross State Product, Salaries and Benefits, Jobs, and Taxes

The IMPLAN results show that firms graduating from or occupying a technology incubator in Maryland in 2006 improve several important indicators of economic health. Gross state product (e.g., salaries, other income, indirect business taxes) increases by $1.2 billion, with a significant portion of this increase resulting from a rise in salaries and benefits[13] ($845 million) (see **Table 2-6**). The associated job increases are estimated to be 14,044 full-time employees. State and local tax revenue increases by approximately $104 million per year.

Table 2-6. Summary of IMPLAN Results: 2006[a]

Variable	Estimates of Impacts
Gross State Product per year ($ Million)	$1,243
Salaries and benefits per year ($ Million)	$845
Jobs	14,044
State and local taxes per year ($ Million)	$104

[a] All monetary values are expressed in 2007 dollars.

Gross State Product Contributions Total $1.2 Billion in 2006

The total annual gross state product (GSP) impacts are on the order of $1.2 billion per year (see **Table 2-7**). GSP measures changes in earnings (employee compensation, proprietor income, and other property income) and indirect business taxes paid by individuals and businesses (primarily excise and sales taxes). As shown in **Figure 2-4** that follows, over half of these additional benefits arise from inter-industry purchases

[13] In this report, salaries and benefits reflect total payroll costs (including benefits) and income received from self-employed work. IMPLAN refers to this measure as "labor income," which includes employee compensation and proprietary income.

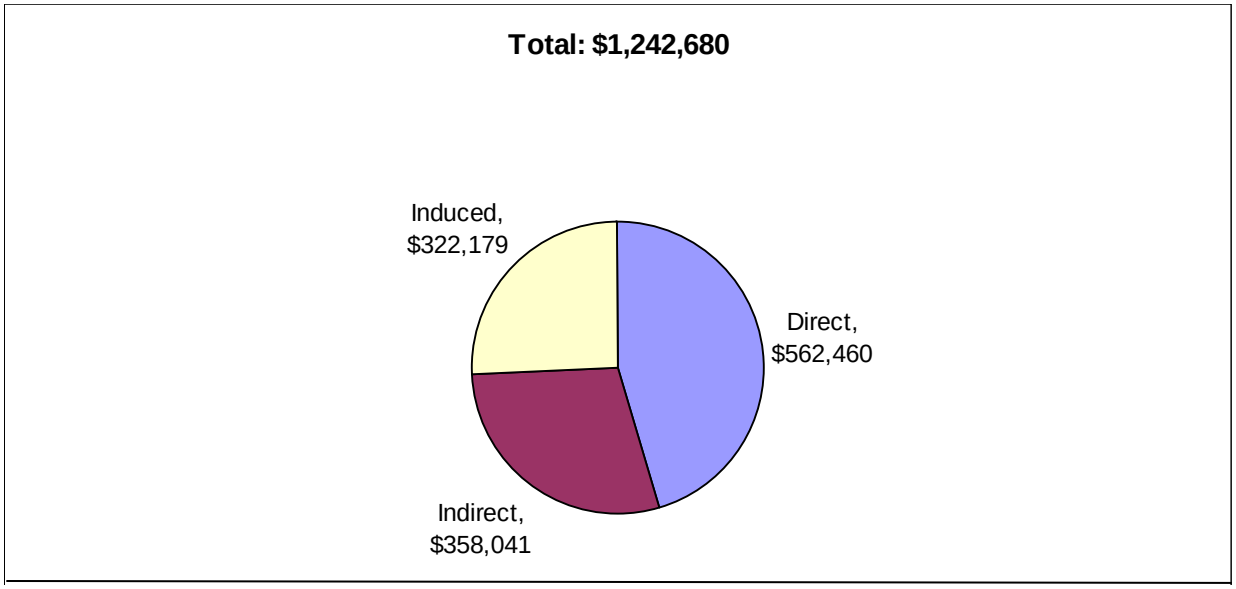
($358 million) and new household spending associated with the extra income earned as the Maryland economy expands ($322 million).

Table 2-7. Technology Incubator Contributions to 2006 Gross State Product by Industry: $1,000[a]

Sector	Direct	Indirect	Induced	Total
Agriculture	$0	$1,029	$1,103	$2,132
Construction	$554	$3,905	$1,787	$6,245
Durable goods manufacturing	$18,047	$4,851	$2,497	$25,395
Education	$3,400	$4,096	$6,963	$14,458
Finance insurance & real estate	$0	$16,246	$24,623	$40,869
Government	$6,965	-$5,205	$10,230	$11,991
Health	$127	$14	$48,708	$48,849
Information	$30,867	$6,303	$1,342	$38,512
Mining	$0	$118	$80	$198
Nondurable goods manufacturing	$167,160	$72,344	$7,625	$247,129
Other services	$2,248	$22,545	$97,744	$122,536
Professional services	$332,721	$164,329	$50,787	$547,837
Retail trade	$0	$5,774	$37,804	$43,578
Transportation	$0	$7,788	$5,406	$13,194
Utilities	$0	$11,124	$9,825	$20,949
Warehousing	$0	$6,510	$604	$7,114
Wholesale trade	$371	$36,271	$15,051	$51,694
Total	$562,460	$358,041	$322,179	$1,242,680

[a] All monetary values are expressed in 2007 dollars.

Figure 2-4. Distribution of 2006 Gross State Product Increases by Type of Economic Effect: $1,000[a]



[a] All monetary values are expressed in 2007 dollars.

Salary and Benefit Contributions Total $845 Million in 2006

The annual salary and benefit contributions associated with technology incubators in Maryland are estimated to be $845 million (see **Table 2-8**). The vast majority of these salaries are paid to people in professional services and non-durable goods sectors. As shown in **Figure 2-5** on the following page, over half of these additional benefits arise from inter-industry purchases ($215 million) and new household spending associated with the extra income earned as the Maryland economy expands ($184 million).

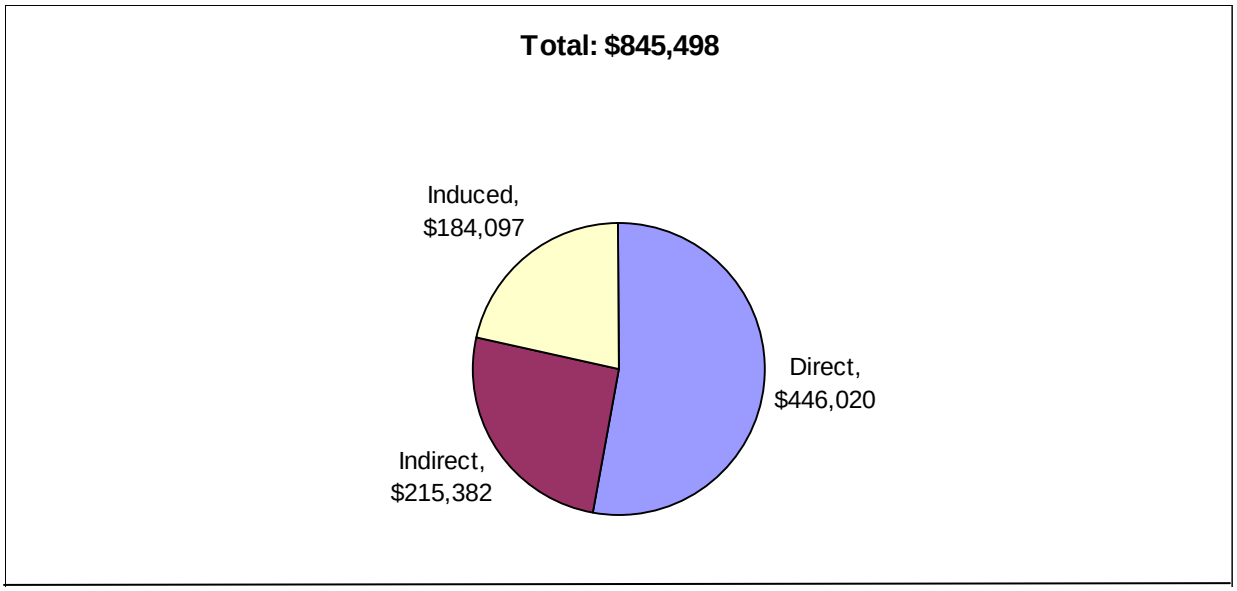
Table 2-8. Technology Incubator Contributions to 2006 Salaries by Industry: $1,000[a]

Sector	Direct	Indirect	Induced	Total
Agriculture	$0	$607	$470	$1,077
Construction	$459	$3,292	$1,515	$5,266
Durable goods manufacturing	$17,793	$3,822	$1,820	$23,435
Education	$2,195	$4,057	$6,715	$12,967
Finance insurance & real estate	$0	$8,854	$14,794	$23,648
Government	$6,849	-$5,571	$9,336	$10,614
Health	$128	$10	$42,540	$42,678
Information	$19,151	$4,652	$979	$24,782

Sector	Direct	Indirect	Induced	Total
Mining	$0	$51	$34	$85
Nondurable goods manufacturing	$83,514	$37,946	$4,470	$125,930
Other services	$1,256	$16,249	$33,780	$51,284
Professional services	$314,470	$102,998	$27,702	$445,170
Retail trade	$0	$3,479	$24,084	$27,564
Transportation	$0	$5,658	$3,901	$9,558
Utilities	$0	$3,485	$3,141	$6,627
Warehousing	$0	$5,853	$543	$6,396
Wholesale trade	$204	$19,940	$8,274	$28,418
Total	$446,020	$215,382	$184,097	$845,498

[a] All monetary values are expressed in 2007 dollars.

Figure 2-5. Distribution of 2006 Salary and Benefit Increases by Type of Economic Effect: $1,000[a]



[a] All monetary values are expressed in 2007 dollars.

Job Contributions Total 14,044 Employees in 2006

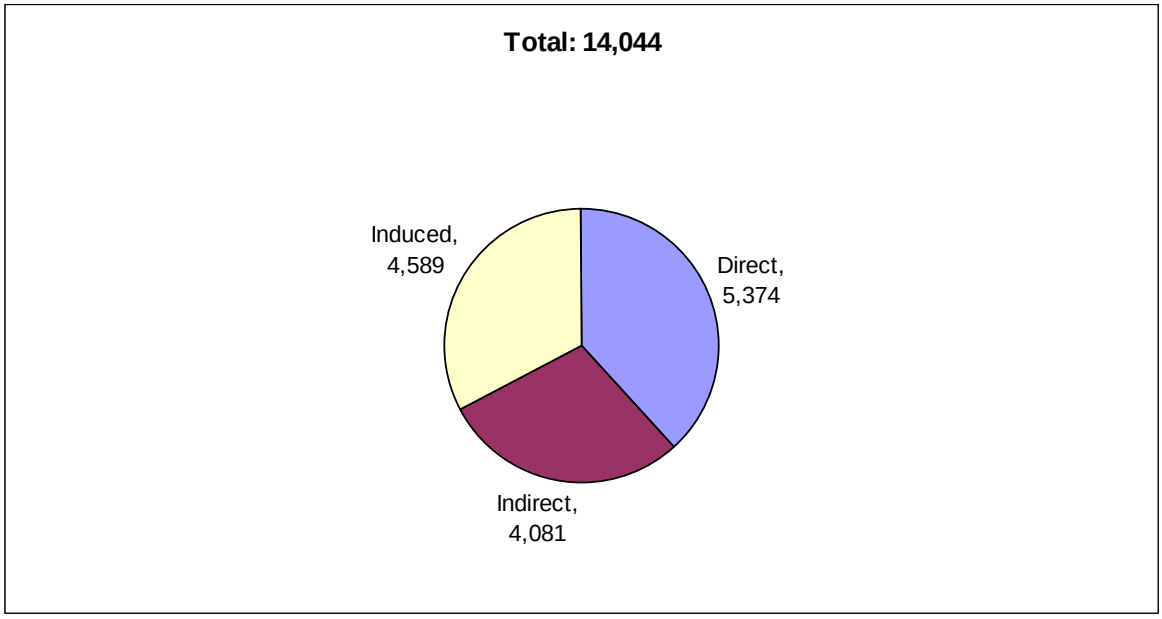
In Section 2.3.1, we determined that firms associated with technology incubators in Maryland created 5,374 jobs in 2006. (All employment effects are measured in FTEs). In addition, these jobs created "downstream" (indirect and induced) effects that resulted in the creation of 8,670 additional jobs in other sectors of the economy. Therefore, the total

annual employment impact of incubator clients and graduates is the creation of 14,044 new jobs throughout the state. A detailed breakdown of these employment impacts by sector is presented in **Table 2-9**. As one can see, the sector categories benefiting most from firms associated with Maryland technology incubators are the professional services and non-durable goods industries. Employment increases in these two sectors account for 56% of total employment change.

Table 2-9. Technology Incubator Job Contributions by Industry: 2006

Sector	Direct	Indirect	Induced	Total
Agriculture	0	19	22	41
Construction	8	59	27	95
Durable goods manufacturing	226	57	25	308
Education	83	92	187	362
Finance insurance & real estate	0	126	213	339
Government	41	-16	94	120
Health	4	0	794	799
Information	140	62	13	216
Mining	0	1	1	2
Nondurable goods manufacturing	737	389	73	1,199
Other services	54	534	1,477	2,064
Professional services	4,078	2,065	629	6,773
Retail trade	0	126	794	919
Transportation	0	149	102	252
Utilities	0	12	11	23
Warehousing	0	132	12	144
Wholesale trade	3	273	114	390
Total	5,374	4,081	4,589	14,044

Figure 2-6. Distribution of Job Increases by Type of Economic Effect: 2006



Assessing IMPLAN Model Results

If analysts incorrectly measure the direct impact of the evaluated program (in this case the initial job creation estimate of 5,374 employees) or the distribution of jobs across industries, the IMPLAN model can substantially overstate the economic effects of a program. In light of these concerns, RTI used an exploratory econometric analysis to evaluate whether the predictions coming from the IMPLAN analysis (employment and personal income changes) substantially exceeded observed historical relationships between incubator establishment and economic activity (see **Attachment G**). As shown in **Table 2-10**, the IMPLAN economic impact estimates fall well within the upper bound suggested in the econometric analysis. Although this test does not provide definitive statements about the precision of the I/O models estimates, this assessment adds value to the analysis by providing some empirical basis for assessing whether model results are credible.

Table 2-10. Comparing IMPLAN Model Results With Econometric Models of Incubator/Economic Activity Relationships

	Percent Change From IMPLAN	Upper bound 95% confidence interval econometric study	Is the IMPLAN estimate consistent with econometric estimates using historical data?
Employment	0.4%	0.8%	Yes
Per capita labor Income	0.5%	1.3%	Yes

2.3.3 Comparing the Relative Influence of Maryland Industries Using IMPLAN

The previous section provided aggregate estimates of the statewide macroeconomic changes that would result from incubator tenant and graduate firm economic activities. In contrast, this section examines the relative importance of individual sectors and demonstrates that technology incubators in Maryland are associated with high-tech sectors that generate significant impacts on the rest of the economy.

Table 2-11 reports the top 10 industries ranked by the number of combined FTEs employed by incubator tenants and graduate firms in those industries. As shown, firms operating in the scientific research and development services sector account for nearly half of all FTEs employed by incubator associated firms.

Table 2-11. Total Employment of Incubator Tenants and Graduates by Industry[a]: 2006

Industry Code	Description	Number of Employees	Percentage of Total
446	Scientific research and development services	2,525	47%
160	Pharmaceutical and medicine manufacturing	715	13%
441	Custom computer programming services	335	6%
423	Information services	242	5%
439	Architectural and engineering services	180	3%
424	Data processing services	179	3%
444	Management consulting services	174	3%
417	Software publishers	140	3%
442	Computer systems design services	133	2%
447	Advertising and related services	126	2%
Subtotal		4,749	88%
Total		**5,374**	**100%**

[a] We include industries that have 50 or more tenant/graduate employees.

Tables 2-12 and **Table 2-13** report employment ranks by client status (i.e., current incubator tenants and graduates). Employment by current incubator tenants appears to be thinly distributed across industries. However, firms operating in data processing, custom computer programming services, and information services account for more than a third of total tenant employment. Since incubator graduates account for the majority of employees, the distribution of employment by incubator graduates across sectors appears similar to employment across all incubator firms as reported in **Table 2-11**.

Table 2-12. Total Employment of Current Incubator Tenants by Industry[a]

Industry Code	Description	Number of Employees	Percentage of Total
424	Data processing services	179	12%
441	Custom computer programming services	169	12%
423	Information services	166	11%
446	Scientific research and development services	128	9%
444	Management consulting services	95	7%
463	Other educational services	83	6%
313	Electromedical apparatus manufacturing	69	5%
450	All other miscellaneous professional and technical services	69	5%
442	Computer systems design services	67	5%
447	Advertising and related services	66	5%
Subtotal		1,091	75%
Total		**1,449**	**100%**

[a] We include industries that have 50 or more tenant/graduate employees.

Table 2-13. Total Employment of Incubator Graduates by Industry[a]: 2006

Industry Code	Description	Number of Employees	Percentage of Total
446	Scientific research and development services	2,397	45%
160	Pharmaceutical and medicine manufacturing	679	13%
441	Custom computer programming services	166	3%
439	Architectural and engineering services	136	3%
417	Software publishers	102	2%
269	All other industrial machinery manufacturing	85	2%
444	Management consulting services	79	1%
423	Information services	76	1%
442	Computer systems design services	66	1%
447	Advertising and related services	59	1%
478	Other amusement, gambling, and recreation industries	51	1%
Subtotal		3,897	99%
Total		**3,925**	**100%**

[a] We include industries that have 50 or more tenant/graduate employees.

Table 2-14 reports the top 10 employment multipliers for sectors that employ more than 50 FTEs among incubator tenants and graduates. As shown, the pharmaceutical and medicine manufacturing sector clearly has the highest employment multiplier, 5.74. This suggests that if the number of employees in this industry increased by 100, the total employment effect (after indirect and induced effects have been taken into account) would be 574 employees (100 x 5.74) or 474 additional jobs. Other important high-impact industries include software publishers (3.76), information services (3.76), and data processing services (3.49).

Also reported are summary statistics of employment multipliers across all IMPLAN sectors in Maryland. According to these statistics, the median employment multiplier for all 509 sectors is 1.98. Six of the 10 sectors included in **Table 2-14** report multipliers greater than 1.98. Further analysis reveals that over 36% of the 5,374 employees included in this analysis are utilized by sectors with employment multipliers exceeding the median Maryland multipliers.

Table 2-14. Incubator Tenants and Graduates Are Associated With High-Impact Industries With Employment Multipliers Above the Median

Industry Code	Description	Employment Multiplier	Rank Among All Maryland Industries
160	Pharmaceutical and medicine manufacturing	5.74	8
417	Software publishers	3.76	39
423	Information services	3.49	47
424	Data processing services	2.67	100
444	Management consulting services	2.06	202
439	Architectural and engineering services	2.03	207
447	Advertising and related services	1.98	229
446	Scientific research and development services	1.89	257
441	Custom computer programming services	1.84	278
442	Computer systems design services	1.74	317
	Summary Statistics, All Maryland Industries		
	Median	1.98	
	Average	2.37	
	Standard deviation	1.66	

As shown in **Table 2-15**, employee compensation (total payroll costs, including benefits) for the majority of sectors containing incubator tenants and graduates is high. The average employee compensation is generally well above the median and average of other Maryland industries. In addition, these industries have high potential for labor income spillovers. For example, pharmaceutical and medicine manufacturing has a labor income multiplier of 3.2. If labor income in this industry increases by $1, then labor income will increase in other industries by $2.2. Summary statistics of labor income multipliers show that the median labor income multiplier in Maryland is 1.76. Three of the sectors included in this table are estimated to have multipliers greater than 1.76. Additional analysis shows that 27% of the 5,734 employees included in this analysis are used by sectors with labor income multipliers exceeding the median.

Table 2-15. Incubator Tenants and Graduates Are Associated With High Impact Industries With Labor Income Multipliers Above the Median

Industry Code	Description	Average Compensation per Employee ($1,000)	Labor Income Multiplier	Rank Among All Maryland Industries
160	Pharmaceutical and medicine manufacturing	$ 95	3.20	22
423	Information services	$ 73	1.91	157
417	Software publishers	$ 93	1.77	217
424	Data processing services	$ 60	1.76	227
447	Advertising and related services	$ 42	1.73	247
439	Architectural and engineering services	$ 55	1.61	320
444	Management consulting services	$ 55	1.59	347
446	Scientific research and development services	$ 60	1.48	402
441	Custom computer programming services	$ 72	1.36	442
442	Computer systems design services	$ 65	1.35	443
	Summary Statistics, All Maryland Industries			
	Median	$ 48	1.76	
	Average	$ 44	1.96	
	Standard deviation	$ 28	0.68	

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3. Maryland's Capacity for New Technology Incubators

3.1 Methodology

Maryland's capacity for new technology incubators is a multi-pronged subject with many pieces to consider. To address this issue, a variety of methods were used. First, RTI performed extensive secondary research into Maryland's high-tech economy and innovation assets to better understand Maryland's existing foundation for technology incubators. Secondary data on employment, establishments, and wages in specific industries also allowed us to analyze the extent to which various industries are concentrated in Maryland.

This data is supplemented with a review of the current and proposed technology incubators in the state. An important method used in this section was the primary research conducted in the incubator client survey. Survey results allowed us to understand the benefits of incubation for clients and the services clients would like to see provided in the future. This suggests demand for additional services at current and potentially new incubators. Finally, our interviews and focus groups with incubator clients, managers, and other stakeholders revealed themes that helped contextualize our findings.

The information presented in this section provides a solid background from which specific analyses can be conducted on an incubator-by-incubator basis. RTI recommends that proposed new projects continue to follow TEDCO's existing policy of conducting thorough feasibility studies to assess the demand and capacity for new technology incubators.

3.2 Maryland's High-Technology Economy and Innovation Assets

A healthy high-technology economy and a strong base of statewide innovation assets are required for Maryland to continue to grow and support technology incubators. In this section, RTI provides a comprehensive overview of the state's technology economy and important institutions and services that support its development.

Background information on Maryland's university assets and contributions, innovation generators and output, workforce, financial capital landscape, and small business climate are all discussed below. This information describes the context in which the high-tech incubators exist. A robust high-tech economy suggests a solid foundation for current technology incubators in the state as well as the potential to support additional incubators.

3.2.1 Universities

Universities play an important role in the high-tech economy and act as powerful technology generators. Data on universities in this section include research centers, licenses and options, and number of start-up companies. This information helps describe the level of universities' contribution to the state's technology-led economic development.

University Research

Maryland boasts many prominent universities with a variety of research centers. These centers as well as many federal research labs are primarily concentrated in the Baltimore and College Park areas. A partial list of university research centers can be found in **Attachment A.**

Academic R&D is also very strong in Maryland. In 2005, a total of $2,357 million of academic R&D was performed in the state, ranking it fourth in the United States and the highest among its peer groups of states.[14] In comparison, Virginia ranked 14th, with $914 million; North Carolina ranked 8th, with $1,652 million; and Massachusetts ranked 6th, with $2,079 million.[15]

Licenses and Options

Universities contribute to the region's economy through the number of patent and copyright licenses and options the institutions generate. As seen in **Figure 3-1,** Maryland performs on par with North Carolina and Virginia while Massachusetts outperforms this peer group. This is true for many of the technology-based economic development indicators discussed in this section.

The following institutions are included for each state in the charts below:

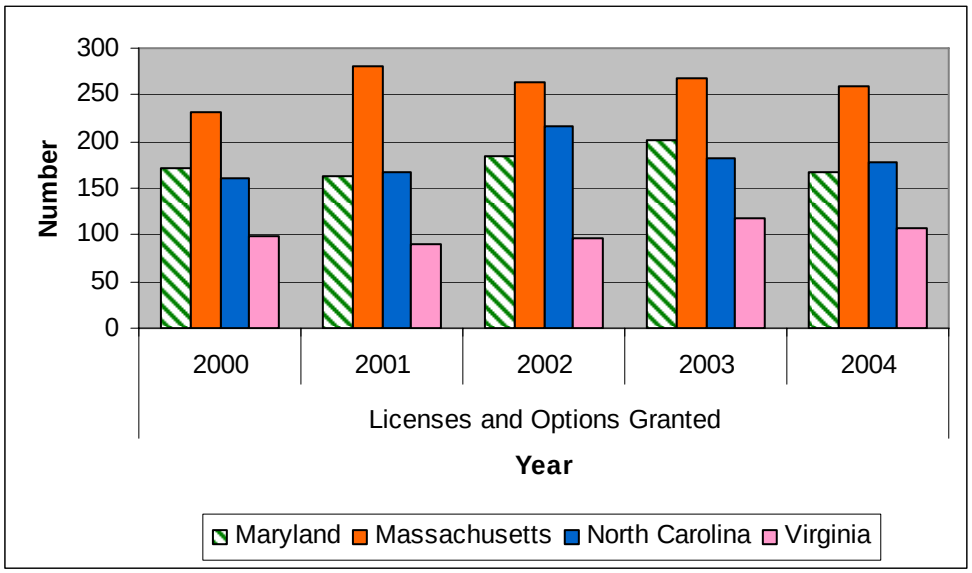
- *Maryland*: Johns Hopkins, University of Maryland College Park, University of Maryland Baltimore, University of Maryland Baltimore County.
- *Massachusetts*: MIT, Harvard, University of Massachusetts all campuses, Boston University, Tufts University, Brandeis University, Northeastern University, Worcester Polytechnic Institute.
- *North Carolina*: North Carolina State University, Duke University, University of North Carolina Chapel Hill, Wake Forest University, UNC Greensboro, UNC Charlotte, North Carolina A&T.

[14] Maryland's peer group of states consists of Virginia, North Carolina, and Massachusetts. These states were chosen by TEDCO for consistency with other research.

[15] National Science Foundation Science and Engineering State Profiles: 2003–05. http://www.nsf.gov/statistics/nsf07322/

- *Virginia*: University of Virginia Patent Foundation, Virginia Tech Intellectual Properties, Inc, Virginia Commonwealth University, Old Dominion University, Eastern Virginia Medical, and George Mason University.

Figure 3-1. Licenses and Options Income Granted

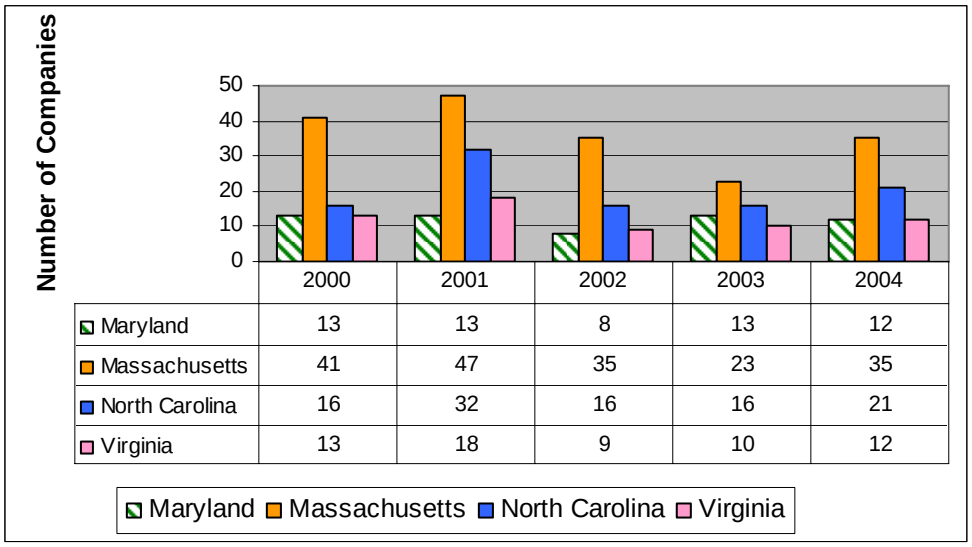


Source: Association of University Technology Managers (AUTM) FY2004 Annual Survey

University Start-Ups

Maryland's universities produce the fewest number of companies when compared to its peer states, a total of 59 from 2000 to 2004. Virginia generates a similar number of companies, with just three more than Maryland. Massachusetts's universities created 181 companies during the same time period. MIT is the source for this impressive figure, starting up118 companies. The remaining Massachusetts universities collectively generated 63 companies, which number is much more in line with the numbers from Virginia and Maryland. **Figure 3-2** shows this data in more detail.

Figure 3-2. University Start-up Companies



Source: Association of University Technology Managers FY2004 Annual Survey

Maryland's low number of university start-ups is surprising given its high level of academic R&D and strong incubator network. Perhaps there is a need for further investigation into this pipeline to identify potential bottlenecks or barriers to university start-ups within the state. These findings could be useful for TEDCO in any future analysis conducted on space availability for technology-based start-up companies.

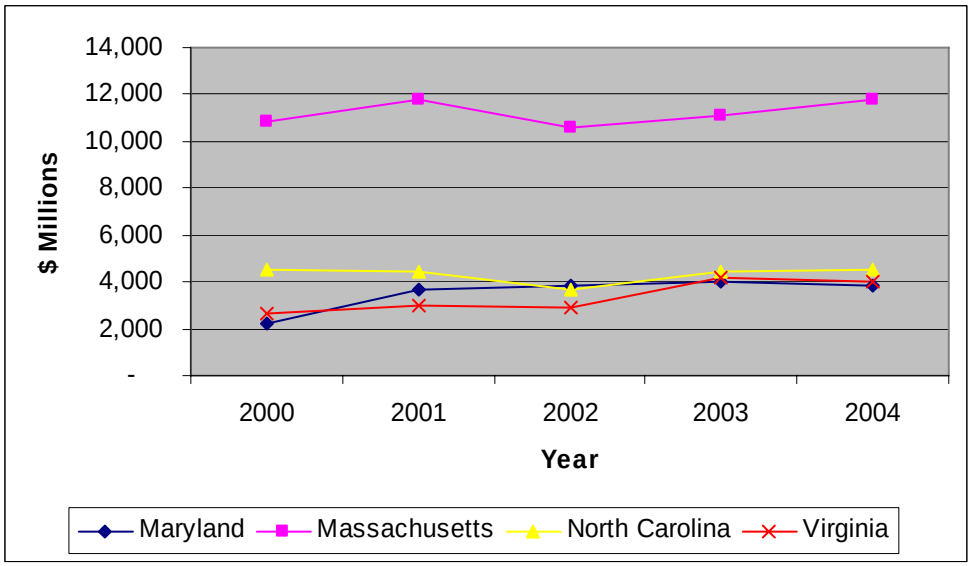
3.2.2 Innovation

Several measures capture innovation's role in spurring economic development. Data were collected for industry R&D, research centers outside the university, and available research space.

Industry R&D Expenditures

Industry R&D is responsible for a significant amount of innovation in the United States. This is important at the state level because industry R&D helps firms remain competitive against outside forces that can encourage businesses to relocate to lower-cost production areas. Maryland's industry R&D grew from 2000 to 2001 to be on par with North Carolina and Virginia. As **Figure 3-3** shows, these three states average around $4 billion in industry R&D. Massachusetts generated significantly more, between $10 and $12 billion.

Figure 3-3. Industry R&D: 2000-2004



Source: Survey of Industrial Research and Development: 2004, Division of Science Resources Statistics, National Science Foundation

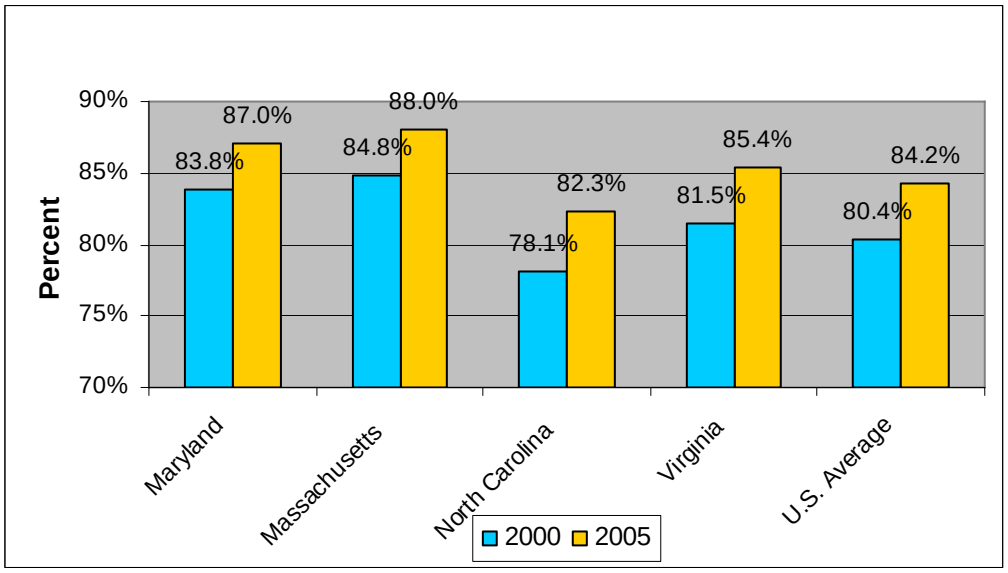
Research Centers Outside the University

Maryland's research centers are core drivers of innovation and technology-based entrepreneurship. These research centers, listed in **Attachment A**, in addition to university-based centers, demonstrate the remarkable spectrum of innovation assets within the state. They are located throughout the state and have a wide variety of research foci. These research centers demonstrate Maryland's promising potential to continue to create incubators that can harness this innovation to create businesses, jobs, and increased wealth in the state.

3.2.3 Workforce

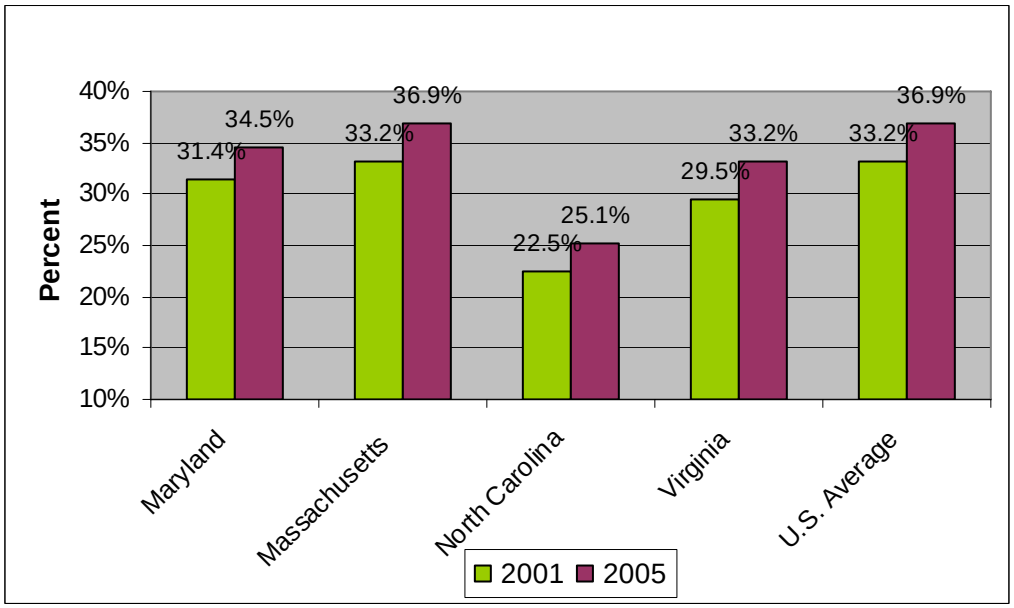
A knowledge-intensive workforce is a fundamental element of a successful innovation economy. For many states, building a knowledge workforce begins with increasing the percent of the workforce with high school and bachelor's degrees. **Figure 3-4** shows that Maryland compares well with its peer states, with 87% of its workforce over the age of 25 having a high school diploma in 2005. Likewise, the state has a comparable rate of its workforce with a bachelor's degree, at 34.5%, just under the U.S. average of 36.9%. This is illustrated in **Figure 3-5**.

Figure 3-4. Population 25 and Older With a High School Diploma



Source: U.S. Census Bureau, Census Fast Facts

Figure 3-5. Population 25 and Older With a Bachelor's Degree

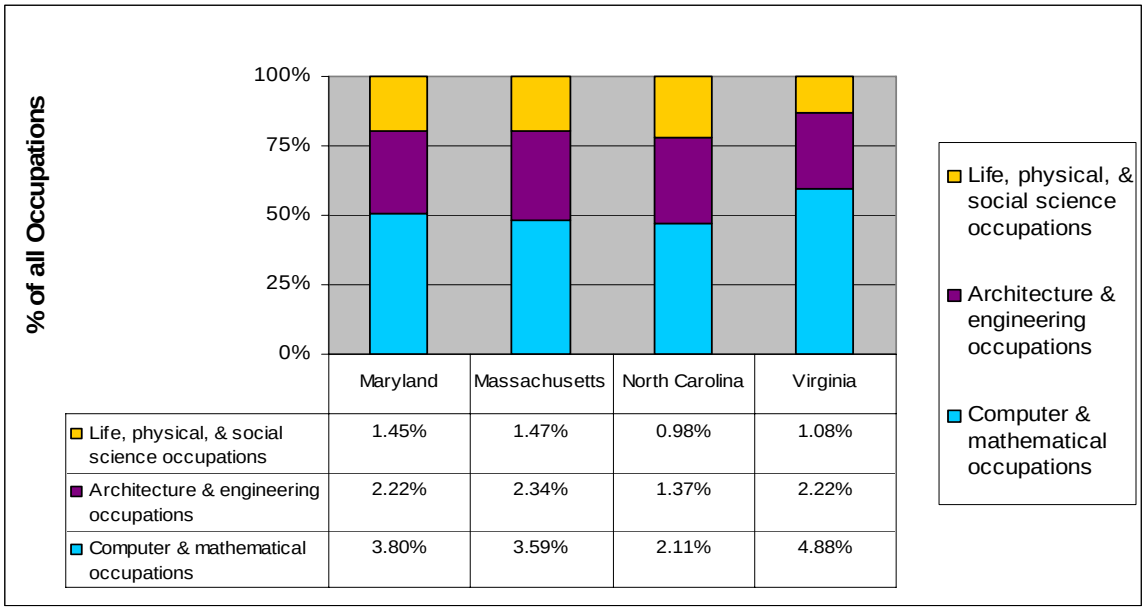


Source: U.S. Census Bureau, Census Fast Facts

Employment in high-technology occupations is particularly important when analyzing the potential for new incubators because these occupations are the ones that drive businesses in high-technology incubators. As illustrated in **Figure 3-6**, Maryland has a larger percentage of high-technology employees in computer and mathematical occupations

than in other high-tech occupations, which is similar to its peer groups. Maryland has a more significant proportion of its technology workforce in life, physical, and social sciences (1.45%), which is almost as high as Massachusetts (1.47%), a recognized national state leader in the life sciences. Virginia and North Carolina each have closer to one percent. In Maryland, the top three occupations within life, physical, and social sciences are market research analysts, chemists, and biological technicians.

Figure 3-6. High-Tech Occupations

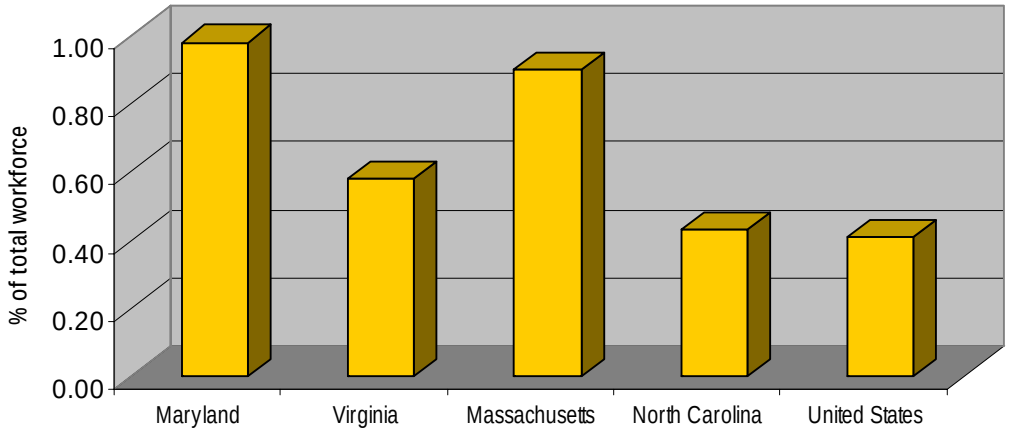


	Maryland	Massachusetts	North Carolina	Virginia
Life, physical, & social science occupations	1.45%	1.47%	0.98%	1.08%
Architecture & engineering occupations	2.22%	2.34%	1.37%	2.22%
Computer & mathematical occupations	3.80%	3.59%	2.11%	4.88%

Source: Bureau of Labor Statistics

The number of science and engineering PhDs in the workforce is another descriptive element that can indicate the potential for technology-led entrepreneurship. **Figure 3-7** shows that Maryland outperforms all of its peer states, including Massachusetts, on this measure. Almost one percent of the workforce in 2003 had a doctorate degree in a science and engineering field.

Figure 3-7. Science and Engineering Doctorates in the Workforce: 2003



Source: National Science Foundation/Division of Science Resources Statistics, Survey of Earned Doctorates, 2005

3.2.4 Capital

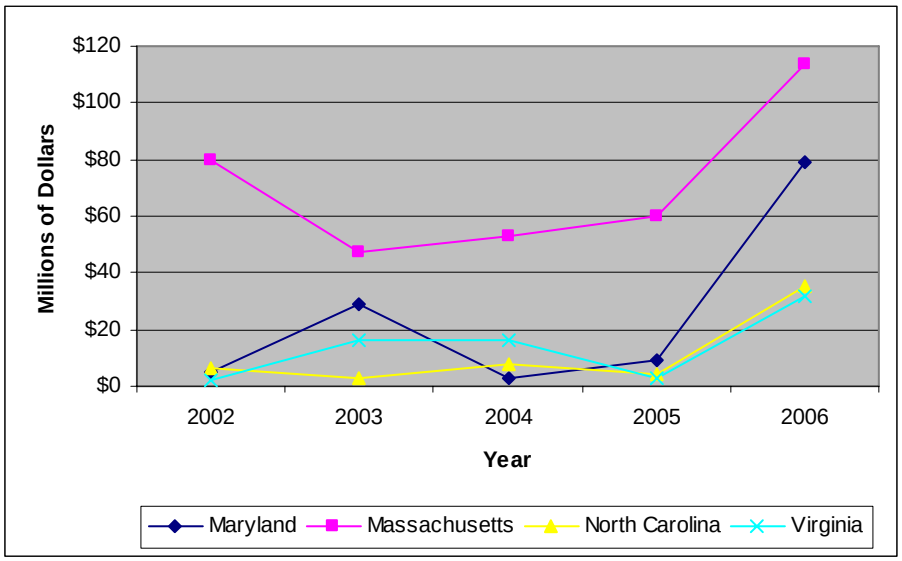
Venture capital is critical to financing high-growth technology-based companies. In this analysis, RTI examined start-up/seed-stage and early-stage capital to provide analysis on capital most relevant for incubator companies. The PriceWaterhouseCoopers Money Tree Report[16] defines start-up/seed stage as the initial stage in which the company has a concept or product under development but is probably not fully operational. The company has usually been in existence less than 18 months.[17] Early stage is defined as the company has a product or service in testing or pilot production. In some cases, the product may be commercially available. The company may or may not be generating revenues and has usually been in business less than three years.

In start-up/seed-stage deals, Maryland has an impressive surge in the amount of venture capital it is investing. In 2006, it had about $80 million, far exceeding Virginia and North Carolina and possibly matching Massachusetts if the trend continues (**Figure 3.8**). In 2005, Maryland experienced a similar surge in the number of deals, surpassing its peer states by over 20 for a total of 40 deals (**Figure 3.9**). In 2006, this number retreated to just over 30 deals, comparing closely with Massachusetts and but remaining far ahead of Virginia and North Carolina

[16] Available online at https://www.pwcmoneytree.com/MTPublic/ns/

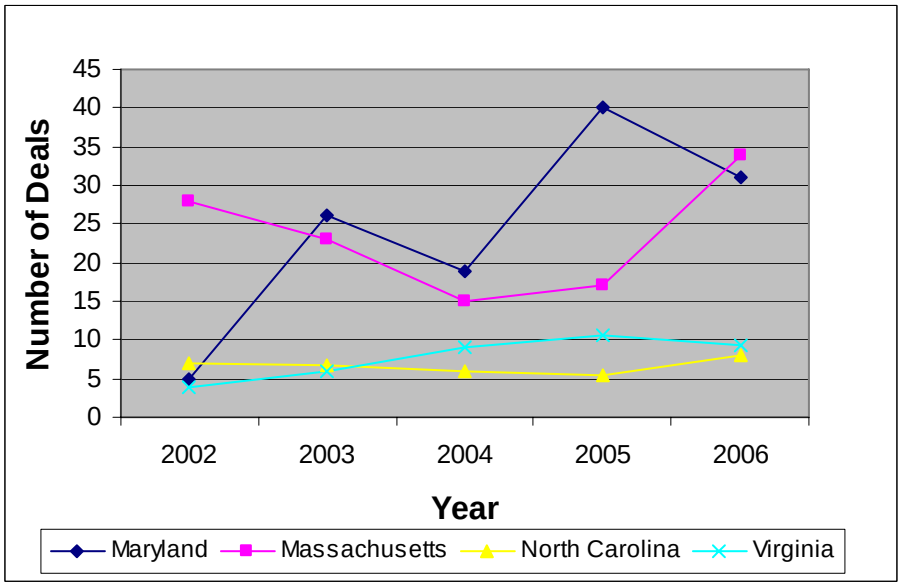
[17] Note that the data sets for the venture capital start-up/seed categories for the state of North Carolina and for the Commonwealth of Virginia were not complete. When missing quarterly data, an average was assumed based on existing data points.

Figure 3-8. Start-up/Seed-Stage Venture Capital Investment



Source: PriceWaterhouseCoopers Money Tree Venture Capital Reports

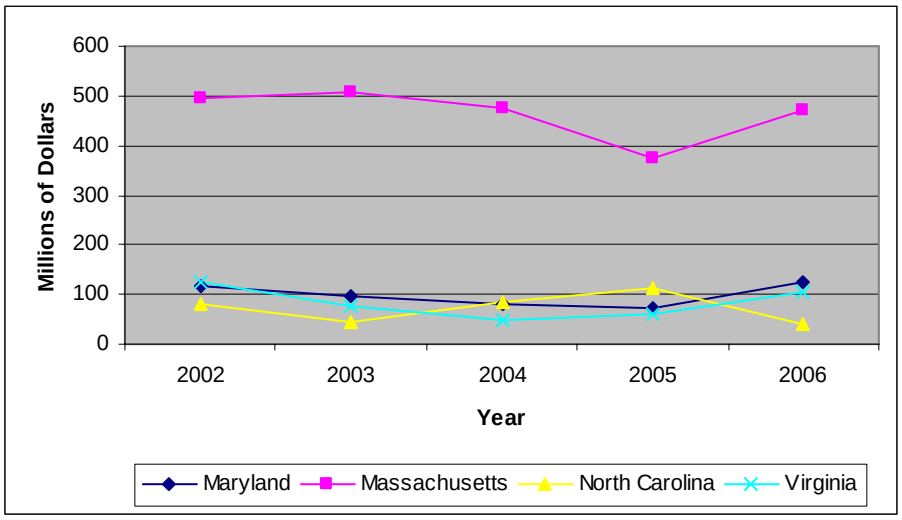
Figure 3-9. Start-up/Seed-Stage Venture Capital Deals



Source: PriceWaterhouseCoopers Money Tree Venture Capital Reports

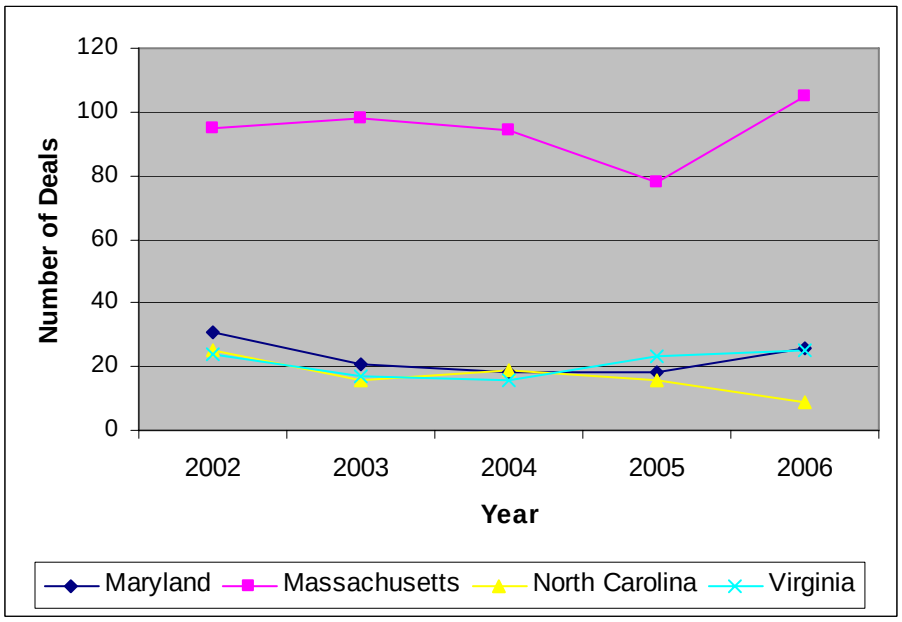
Early-stage deals for this same time period show that Maryland is much more consistent with its peer states by falling behind the outlier that Massachusetts often creates within high-technology economic benchmarks. The amount of early-stage investments dipped slightly for Maryland from 2003 to 2005, but it picked back up again in 2006 (**Figure 3-10**). The number of these deals reflects a similar pattern (**Figure 3-11**).

Figure 3-10. Early-Stage Venture Capital Investment



Source: PriceWaterhouseCoopers Money Tree Venture Capital Reports

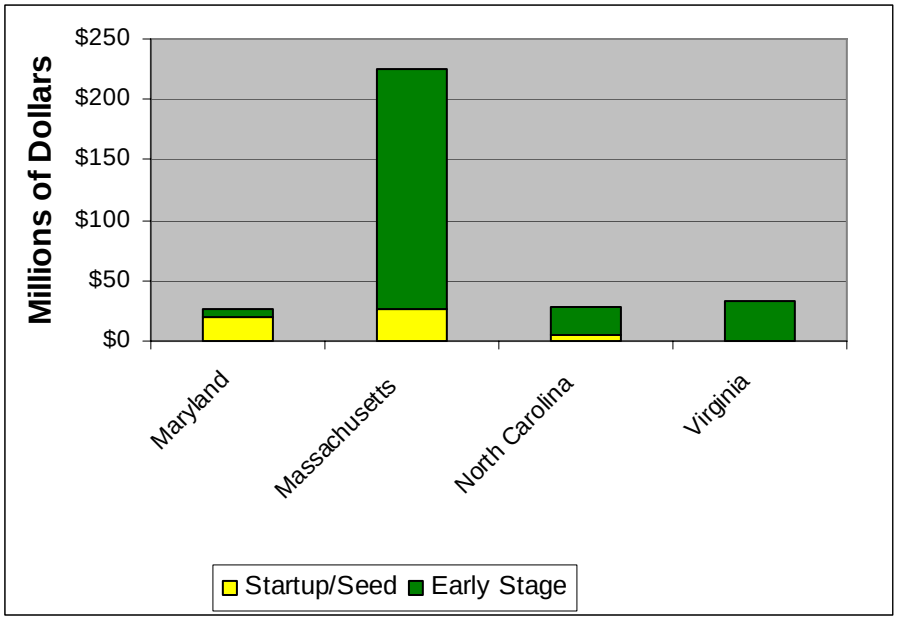
Figure 3-11. Early-Stage Venture Capital Deals



Source: PriceWaterhouseCoopers Money Tree Venture Capital Reports

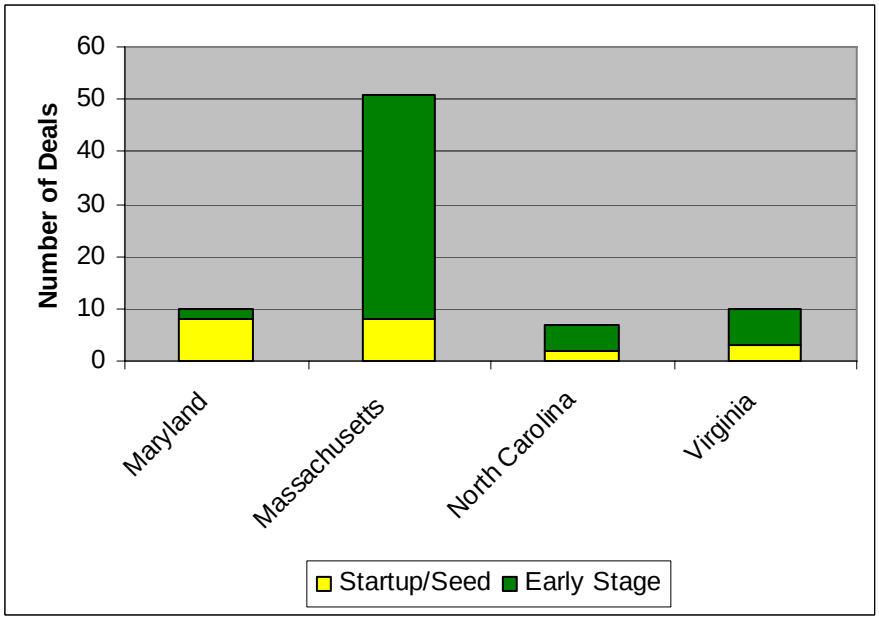
These last two charts (**Figure 3-12** and **Figure 3-13**) provide a snapshot of the most current data on start-up/seed-stage and early-stage venture capital. Again, it is apparent that Massachusetts remains a front runner in venture capital deals, while the other peer states perform at a similar level. Maryland continues to demonstrate strength in start-up/seed-stage funding over early-stage deals.

Figure 3-12. Start-up/Seed-Stage and Early-Stage Venture Capital Deals: Quarter 2, 2007



Source: PriceWaterhouseCoopers Money Tree Venture Capital Reports

Figure 3-13. Start-up/Seed-Stage and Early-Stage Venture Capital Deals, Quarter 2, 2007



Source: PriceWaterhouseCoopers Money Tree Venture Capital Reports

Venture funds, angel groups, and other state funding resources

The Chesapeake Emerging Opportunities Club is an example of an angel fund located within the state of Maryland. The club meets on a monthly basis to discuss potential investment options in start-up companies. Initial investments are usually well above the $100,000 mark with the potential for future investments.

Venture capitalists also provide a form of investment opportunities for start-up companies. Global Insights[18] reports that companies backed by venture capital have contributed over $30 billion to Maryland's economy in 2005. According to Massinvestor Publishing, there are 46 venture capital, private equity, angel, and incubator investor firms operating in Maryland.[19] A list of these firms is provided in **Attachment C**.

PriceWaterhouseCoopers Money Tree Venture Capital Report augments this list with a recent quarterly report for Maryland-based venture capital investment activity. Nineteen firms have made investments in the most recent quarter (Q2 2007). It is important to note that these firms did not necessarily invest in Maryland; they are just based in the state. This list is also in **Attachment C**.

3.2.5 Small Business

Small business plays a key role in all state economies. Small technology-based companies in particular are an important factor for state policy makers to pay attention to because they are often the source for new jobs and new companies on which the state can build a strong innovation-led economic base. The Small Business Administration claims that "Though they [small business] are not by themselves the entire engine of economic growth, they are an indispensable component of that mechanism. Their work underlies the incredible changes in the sources of the power that turns the wheels and drives the vehicles, as well as the more than dramatic upheavals in the means of communication and in the techniques of preservation of information—the three elements that can be said to be most responsible for the historically unprecedented growth of prosperity of much of the modern world."[20]

While no appropriate data is available for economic contributions for small technology-based businesses, RTI analyzed economic contribution data for general small businesses as a proxy to show the extent to which small technology businesses play a role in the

[18] Global Insight and the National Venture Capital Association. 2007. "Venture Impact: The Economic Importance of Venture Capital Backed Companies to the U.S. Economy" at http://www.globalinsight.com/PressRelease/PressReleaseDetail8726.htm.

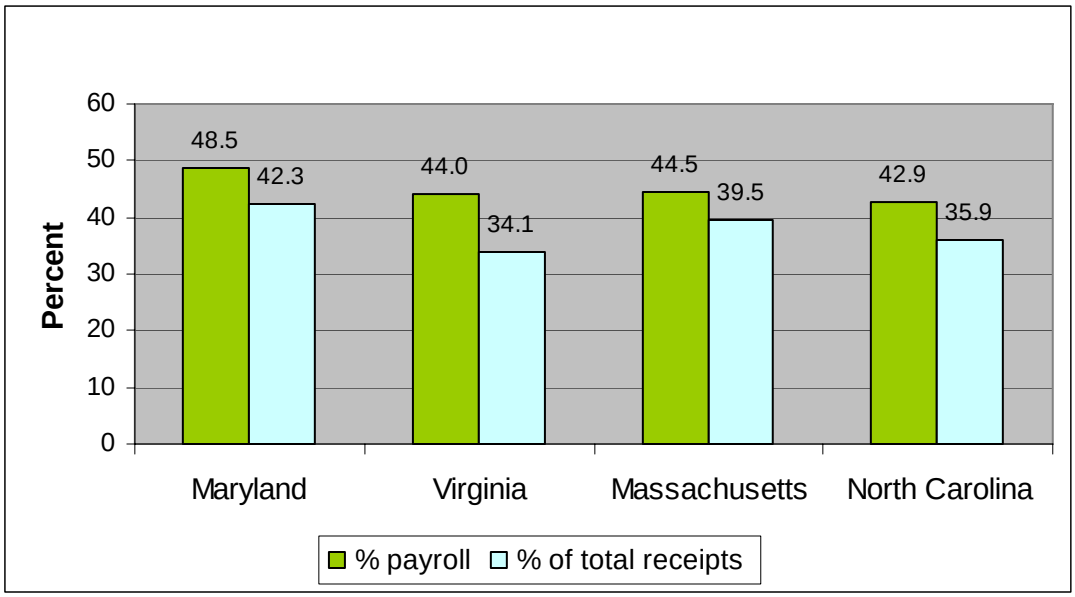
[19] Massinvestor Inc., provides a comprehensive listing on venture capital firms in its "Mid-Atlantic Venture Capital and Private Equity Directory," available for purchase from their Web site at http://www.massinvestor.com/midatlantic_vc.htm.

[20] *The Small Business Economy: A Report to the President.* Small Business Administration. 2005. Available at: http://www.sba.gov/idc/groups/public/documents/sba_homepage/ebeconomy2005.pdf.

statewide economy. In this analysis, small business is defined as firms with 500 or fewer employees.

Figure 3-10 points out that almost half of Maryland's payroll comes from small business, and 42% of all receipts come from small business.

Figure 3-10. Economic Contributions of Small Business in 2004 (Payroll) and 2002 (Receipts)



Source: Small Business Administration, Office of Advocacy

Tax policy and financial assistance

Tax policy is an important piece of the entrepreneurial climate in a state. **Table 3-1** describes Maryland's corporate and personal income tax burden as compared to other states.

Compared to the peer group, Maryland's corporate and individual income tax are relatively competitive among these peer states.

Table 3-1. Corporate and Individual Income Tax Rates

State	Corporate Income Tax	Individual Income Tax
Maryland	**7.0**	**2.0-4.75**
Massachusetts	9.5	5.3
North Carolina	6.9	6.0-8.0
Virginia	6.0	2.0-5.75

Source: Tax Federation for America

According to the Tax Foundation, Maryland's state and local tax burden is 10.8% of income, ranking 23rd nationally and being just under the national average of 11%.[21]

Financial assistance

There are three prominent state funding entities most relevant for small technology-based Maryland companies.[22] They are Maryland Technology Development Corporation (TEDCO), The University of Maryland, and the Maryland Department of Business and Economic Development. These entities run key financial assistance programs relevant for innovation-led entrepreneurs. They are listed in further detail below.

TEDCO Programs[23]

- Maryland Technology Transfer Fund (MTTF)

The MTTF fund, administered by TEDCO, supports collaborations between private companies and federal laboratories or in-state universities. A maximum $75,000 is available to help entrepreneurs developing early-stage technology. Participating companies must have no more than 15 employees, or they must be a previous spin-off of a federal laboratory or university that is no more than five years old and is pre-revenue or pre-venture investment.

- The Working Capital Loan Fund

The Working Capital Loan fund is also run by TEDCO. It provides loans to early-stage technology-oriented companies located in Maryland. Loans of between $15,000 and $50,000 are available to be used for working capital to assist a company with expansion, market entry, or other initiatives.

[21] Maryland State-Local tax Burden Compared to U.S. Average. The Tax Foundation. 2007. Data available at: http://www.taxfoundation.org/taxdata/show/459.html and http://www.taxfoundation.org/research/topic/34.html.

[22] Maryland Department of Business and Economic Development. On the Web at http://www.choosemaryland.org/businessservices/marylandventurefund/vcresources.html.

[23] http://www.marylandtedco.org/tedcoprograms/fundingopportunities.cfm

- Fort Detrick Technology Transfer Initiative

The Fort Detrick Technology Transfer Initiative awards up to $50,000 to for-profit small businesses in support of technology development projects where the proposed technology meets the technology needs of the Army.

- Johnson and Johnson Investment Fund

The joint TEDCO-J&J seed stage investment program is a component of the MTTF. The joint program provides J&J with valuable insight into the most promising technologies being licensed to the private sector by the universities and federal labs in Maryland, which could provide pipeline product opportunities. It would provide MTTF awardees with the valuable commercial input and funding required to build a sustainable company that would meet Johnson & Johnson's requirement for eventual equity investment through its venture capital group (JJDC) or licensing of products and technologies to one of its operating companies. The program provides TEDCO supplemental funding for the MTTF program and valuable connections for its portfolio companies.

- Maryland Minority Research and Development Initiative

This program is designed to increase minority- and women-owned businesses' access to federal grants for early-stage research and development projects, specifically the Small Business Innovative Research and Small Business Technology Transfer federal grant awards (SBIR/STTR). The initiative achieves this through targeted training and business assistance, pre-submission proposal reviews, and access to the equipment and expertise of the University of Maryland and the federal laboratories within the state.

- TechStart Program

This program funds university-based teams to determine whether specific technologies proposed by the universities have the potential to be commercialized through a start-up company. Proposals are initially capped at $15,000 per technology and assist universities that have decided a disclosed technology may have the potential to be a start-up company. TEDCO uses this funding to support further evaluation of the opportunity.

- University Technology Development Fund (UTDF)

This fund provides resources to Maryland universities to support pre-commercial research on university intellectual property to increase the likelihood of commercializing that intellectual property. The program helps universities license early-stage technologies more effectively and serves as a source of technology development projects for Maryland companies eligible for additional TEDCO and other State financing programs. Universities are obliged to share revenues with TEDCO on intellectual property created or developed with a UTDF grant.

University of Maryland[24]

The Maryland Industrial Partnerships (MIPS) program funds collaborative R&D projects between companies and University System of Maryland faculty.

MIPS provides funding, matched by participating companies, for university-based research projects that help companies develop new products. MIPS projects help companies find solutions to technical challenges, as well as develop products, processes, or training materials. MIPS projects are conducted by university faculty and graduate students in conjunction with company researchers.

The Department of Business and Economic Development[25]

DBED manages two programs through the Maryland Venture Fund (MVF): the Challenge Investment Program for early-stage seed projects and the Enterprise Investment Fund for high-tech companies seeking initial rounds of private equity. According to the MVF Website, "The Challenge Investment Program has made over 127 investments since 1994, resulting in a total investment of over $10.8 million. The Enterprise Investment Fund has made equity investments into 63 individual firms."[26]

Entrepreneurial support system

A wealth of small business support services is available in Maryland.[27] This section describes the most relevant support service providers for small technology-based businesses.

Maryland Department of Business and Economic Development

The department's mission is to attract new businesses, stimulate private investment and create jobs, encourage the expansion and retention of existing companies, and provide businesses in Maryland with workforce training and financial assistance.

Maryland Technology Enterprise Institute

MTECH is a unit of the engineering school at the University of Maryland. It seeks to accelerate new ventures, spur economic growth, and bring university innovation to Maryland companies through technology entrepreneurship and partnership programs. It does this by providing entrepreneurship education and other services and resources to entrepreneurs committed to bridging the gap between technical ideas and viable ventures.

[24] http://www.mips.umd.edu/

[25] http://www.choosemaryland.org/businessservices/marylandventurefund/mvf.html

[26] Ibid.

[27] For a complete list, please see Maryland's Department of Business and Economic Development's Web site: http://www.choosemaryland.org/businessservices/businessservicesindex.html.

MTECH also leverages its university assets to partner with other technology-based entrepreneurship initiatives.[28]

Maryland Technology Development Corporation

TEDCO was created to facilitate the creation of businesses and foster their growth in all regions of the state through the commercialization of technology.

Small Business Development Centers

The small business development center network provides management, training, and technical assistance to Maryland's small businesses. It is a partnership between the U.S. Small Business Administration and the University of Maryland College Park, and links private enterprise, government, higher education, and local economic development organizations. The network has six regional offices, and more than 20 statewide locations.[29]

Maryland Industrial Partnerships Program (MIPS)

The MIPS program works to accelerate the commercialization of technology in Maryland by jointly funding collaborative R&D projects between companies and University System of Maryland faculty. The program provides funding, matched by participating companies, for university-based research projects that help companies develop new products. MIPS projects help companies find solutions to technical challenges as well as develop products, processes, or training materials.[30]

Technology Councils

The Technology Council of Maryland is a consortium open to high-technology firms, government laboratories, higher education institutions, and business support firms that collectively form Maryland's technology community. It seeks to develop linkages among industry, government, and higher education institutions. In addition, the Council serves as a united voice for technology in Maryland, encourages entrepreneurship as an economic engine, and works to enhance public understanding of technology and related issues.[31]

Technology Transfer Offices

Technology transfer offices at universities across the state provide support services for university-based entrepreneurs. The University of Maryland's Office of Technology Transfer supports technology transfer system-wide, and Johns Hopkins University also has an active Office of Technology Transfer.

[28] http://www.mtech.umd.edu/
[29] http://www.mdsbdc.umd.edu/mission.html
[30] http://www.mips.umd.edu/
[31] http://www.mdhitech.org/News/html/11.html

Maryland Technology Extension Service

This service is an extension of the University of Maryland and provides manufacturing advice and assistance. It provides business and technical solutions to industrial companies in Maryland.

3.3 Current Incubator Landscape

To assess Maryland's potential for new high-tech incubators, RTI reviewed Maryland's current incubator landscape in addition to the state's high-tech economy. Together, these analyses help frame the state's ability to absorb additional incubators in the future. Maryland currently has a strong network of technology incubators, and in this section, we will take a closer look at current incubators and the perspectives of their clients, managers, and stakeholders to gain insight into current incubator services.

3.3.1 Current Technology Incubators Included in this Report

This study includes 18 technology incubators operating in Maryland. These incubators are detailed in **Table 3-2**. The majority of them are located in the Montgomery, Prince George's, Howard, and Baltimore counties area. Over half of the incubators have a general high-tech focus with no specific industry concentration. The rest target specific industries while also focusing on general high-tech. Examples of industry foci include various biotech-related sectors, information technology (IT), and homeland security. The two newest incubators, TowsonGlobal and Rockville Innovation Center, have an international focus.

Table 3-2. Current Technology Incubators

Incubator	County	Targeted Industries
Tawes Incubator Allegany Business Center	Allegany	Biotech, IT, Environmental Science, Educational Software
Chesapeake Innovation Center	Anne Arundel	Homeland and National Security
Emerging Technology Center @ Johns Hopkins Eastern Emerging Technology Center @ Canton	Baltimore	General High-tech, Biotech
Techcenter @ UMBC	Baltimore	General High-tech, Bioscience
TowsonGlobal (new)	Baltimore	International companies, Domestic companies seeking international markets
University of Maryland-Baltimore	Baltimore	Life Sciences
Frederick Innovative Technology Center, Inc. @ Hood Frederick Innovative Technology Center, Inc. @ Monocacy	Frederick	IT, Biotech
Garrett Information Enterprise Center	Garrett	General High-tech
Higher Education and Applied Technology Center	Harford	General High-tech
Neotech Incubator	Howard	General High-tech
Maryland Technology Development Center	Montgomery	General High-tech, Bioscience

Rockville Innovation Center (new)	Montgomery	International, Bioinformatics
Silver Spring Innovation Center	Montgomery	General High-Tech, Multi-media, Wireless
Prince George's County Technology Assistance Center	Prince George's	General High-tech
Technology Advancement Program at University of Maryland	Prince George's	General High-tech
Technical Innovation Center at Hagerstown Community College	Washington	Manufacturing, General High-Tech

3.3.2 Proposed Technology Incubators Reviewed in the Study

Four proposed incubator and accelerator projects are also reviewed in addition to the operating technology incubators in the state. These proposed projects are listed in **Table 3-3**. Similar to the existing technology incubators, these proposed projects are also concentrated in the Montgomery and Baltimore counties area. It is important to point out that one of the projects is located in Dorchester County and will provide incubator space on the Eastern Shore.

Two of the proposed projects are projected to open in 2008, and the other two projects have timelines extending past next year.

Table 3-3. Proposed Incubator and Accelerator Projects

Incubator	County	Location	Type of Project	Targeted Industries	Status	Fit in current landscape
East Baltimore Development Inc.	Baltimore	Baltimore City, near the Johns Hopkins Hospital	Incubator	Biotech	Expected to open within next two years.	Will serve unfilled need for wet lab space in Baltimore City.
Dorchester County	Dorchester	Dorchester County Technology Park	Incubator	Technology, with focus on environmental science, marine science, agricultural science, and IT	Expected to open within the next two years.	Will serve the unfilled need for incubators on the Eastern Shore.
Germantown	Montgomery	Adjacent to Montgomery College campus in Germantown	Incubator	Biotech and IT	Expected to open in first quarter of 2008.	Will add additional needed wet lab spaces of various sizes.
White Oak Innovation Center	Montgomery	Undecided – probable location near new FDA campus in Montgomery County	Incubator	Technology – specifics undecided	Expected to open within the next two years.	Unclear at this time.

3.3.3 Survey Results and Interview Themes: Existing Incubator Services and Other Client Issues

The technology incubators in Maryland offer a range of comprehensive services and resources to clients. Overall, both current incubator clients and incubator graduates were very satisfied with their incubator experience. **Table 3-4** shows that respondents felt that their time in the incubator was very important to their business.

Table 3-4. Overall Importance of Incubator Experience

Client Type	Mean Rating (0–4 scale, 4 is extremely important)
Current client	3.1
Graduate	3.2

The importance of specific services offered by the technology incubators were also rated by survey respondents. **Table 3-5** and **Table 3-6** show that the most important service provided by the incubators for both current and graduate incubator clients was affordable, functional space. However, space was not the only service rated as very important by survey respondents. All the other services rated at least 1.6 on a scale of 0–4, indicating that incubator clients valued every rated service to some extent. The exception was shared biotechnology equipment; graduate respondents overall gave this service a lower rating, at 1.2. However, when only the responses to this question from biotechnology companies were analyzed, shared biotech equipment was rated as more important, receiving a 1.7 from graduates and a 2.8 from current clients.

Table 3-5. Current Clients: Most Important Incubator Services

Service	Mean Rating of Companies Offered Service (0–4 scale)
Affordable, functional space	**3.6**
Shared office facilities	2.9
Access to mentors, services	2.7
Individual business counseling	2.6
Incubator company networking	2.6
Connections to funding sources	2.5
Training programs/workshops	2.1
Access to univ. IP/tech transfer	1.9
Legal clinic/assistance	1.8
Shared biotech equipment	1.7
Shared biotech equipment, biotech companies only	2.8

Table 3-6. Graduates: Most Important Incubator Services

Service	Mean Rating of Companies Offered Service (0–4 scale)
Affordable, functional space	**3.5**
Shared office facilities	3.0
Access to mentors, services	2.7
Individual business counseling	2.5
Incubator company networking	2.5
Connections to funding sources	2.2
Training programs/workshops	1.9
Access to univ. IP/tech transfer	1.7
Legal clinic/assistance	1.6
Shared biotech equipment	1.2
Shared biotech equipment, biotech companies only	1.7

Current incubator services were also a major topic of discussion in focus groups held with current incubator clients. While the services considered most important did vary somewhat by incubator, a majority of the 19 companies that participated in focus groups felt that space was the most valuable resource provided by the incubator. The actual physical space was important, as well as other more subtle aspects of it. Companies felt that the flexibility of the space was very valuable, and they also viewed their location in an incubator as giving them more credibility as businesses than is provided by locating in a home office environment. Biotech companies that required wet lab space valued the lab space provided by the incubators very highly; many of them felt that no suitable wet lab space was available to them outside the incubator. Focus group participants also cited co-location with other entrepreneurs as valuable for the positive energy and atmosphere created, as well as the increased ease and incidence of partnering with firms located together in an incubator.

Interviews with incubator managers also produced a variety of common incubator resources that the managers felt were most valuable to their client companies. Managers agreed with companies that the reputation and credibility afforded companies located in an incubator was important. They also cited co-location and networking with other entrepreneurs as valuable aspects of incubator tenancy.

One resource cited as important by managers is notable for its contrast to the responses from incubator companies. Managers felt that the most important resource provided by

incubators was the business mentoring, advising, and customized, one-on-one support provided to clients. While some companies did cite this as an important resource, it was not a consistent theme for them. Furthermore, as will be discussed later in this report, companies cited personalized business counseling as a service they would value but, on the whole, are not currently receiving. One incubator had particularly strong accolades for its tailored and well-thought-out one-on-one assistance. This was a notable exception to this finding.

In addition to services and resources provided by incubators, clients are affected by their tenancy in other ways. Survey respondents were asked about the effects of their incubator tenancy on their ability to raise capital and license technology from a university. **Table 3-7** and **Table 3-8** below show clearly that the respondents' incubator status generally had no effect on their ability to license university technology and raise capital, and in many cases, it improved their ability.

Table 3-7. Current Clients: Effects of Incubator Tenancy

Service/Facility	Improved	Hampered	No Effect	NA
Has your incubator tenancy/affiliation affected your company's ability to raise capital?	47	0	29	23
Has your incubator tenancy/affiliation affected your company's ability to license technology from a university?	17	0	29	53

Table 3-8. Graduates: Effects of Incubator Tenancy

Service/Facility	Improved	Hampered	No Effect	NA
Did your incubator tenancy/affiliation affect your company's ability to raise capital?	13	0	11	8
Did your incubator tenancy/affiliation affect your company's ability to license technology from a university?	4	0	12	16

Clients were also surveyed about the effects of their incubators' equity or royalty stake in their companies. The National Business Incubation Association's 2006 State of the Business Incubation Industry report notes that while 75% of all incubators do not take equity in their clients, 46% of technology incubators do take equity in some or all of their clients. Interestingly, as shown in **Table 3-9** and **Table 3-10** that follow, only one quarter of respondents indicated that the incubator had an equity or royalty stake in their company. The effects of the stakes were largely neutral for the companies themselves, as the majority reported that the stake had no effect on company's ability to procure venture capital investment.

Table 3-9. Current Clients: Effects of Equity/Royalty Stakes

	Yes	No	
A. Does the incubator have an equity or royalty stake in your company?	26	73	
For those that answered "Yes" to part A:	**Improve**	**Hamper**	**No Effect**
B. Does this equity/royalty stake improve, hamper, or have no effect on your firm's ability to procure venture capital investment?	2	2	22
For those that answered "Yes" to part A:	**Incentive**	**Disincentive**	**No Impact**
C. Did the incubator's equity/royalty stake act as an incentive, disincentive, or have no impact on your firm's decision to locate in the incubator?	1	5	19

Table 3-10. Graduates: Effects of Equity/Royalty Stakes

	Yes	No	
A. Did the incubator have an equity or royalty stake in your company?	8	24	
For those that answered "Yes" to part A:	**Improve**	**Hamper**	**No Effect**
B. Did this equity/royalty stake improve, hamper, or have no effect on your firm's ability to procure venture capital investment?	0	2	6
For those that answered "Yes" to part A:	**Incentive**	**Disincentive**	**No Impact**
C. Did the incubator's equity/royalty stake act as an incentive, disincentive, or have no impact on your firm's decision to locate in the incubator?	0	3	5

Conversely, the equity and royalty stakes may have some effect on the ability of the incubators themselves to find tenants. While most of the incubator managers interviewed indicated that they had little if any problem maintaining an acceptable occupancy level in their incubator, almost one quarter of the companies in which an equity or royalty stake was taken felt that it was a disincentive to locating in the incubator.

Company focus group discussions provided more insight into the effects of equity and royalty stakes. The majority of companies accepted the stakes as fair and reasonable for several reasons. Many companies stated that the benefits of their incubator tenancy far outweighed the costs of the stakes. Other companies stated that they "did not care" about the stakes because they were small enough to be trivial. Finally, some incubator companies felt that the stakes were a fair trade for the incubator services and made the

incubator-tenant relationship seem more like a partnership, creating additional incentives on the part of the incubator to help the company succeed. It is worth noting that a minority of companies were very unhappy with the equity and royalty stakes. One of the companies who felt particularly strong about this issue said, "The royalty thing is nonsense. Just increase the rent if the money is not enough."

The issue of equity and royalty stakes has another facet in addition to the effect on companies in which stakes are taken. Interviews with incubator managers revealed mixed feelings about TEDCO's requirement that incubators receiving capital funding for the incubator facility from TEDCO take equity and royalty stakes in their tenant companies and return some of the proceeds as a funding payback. Incubator managers varied widely on this issue, with feelings on the issue running the gamut from a perception of the requirement being reasonable and flexible to a likening of the grant payback requirement to a high-interest loan from TEDCO.

The final facet of the current incubator landscape explored in this study was political support for incubators. Almost all interviewees and focus group participants agreed that strong political support for incubators in Maryland exists on both the state and local levels. Most interviewees felt that TEDCO was a national leader in promoting business incubation and the state stood behind their efforts. The only negative theme relating to political support that emerged was a sense that state funding for incubation has dropped in recent years and that funding is concentrated on building incubators rather than, instead of in addition to, supporting operating costs.

3.4 Potential for New High-Tech Incubators

The previous sections of this study provide an analysis of Maryland's high-tech economy and various aspects of the technology incubators that currently exist in the state. In this section, these analyses in conjunction with additional analysis will explore the potential for new technology incubators in Maryland.

It is important to note that TEDCO currently has a feasibility study policy in place for proposed new technology incubator projects. Recommendations made in this report are intended to supplement and inform TEDCO's existing processes and do not supersede the requirements for any new proposed TEDCO-funded incubator project.

High-Tech Industry NAICS-based Definition

In order to use economic development analysis techniques to gain an additional perspective on the potential for new high-tech incubators in Maryland, RTI and TEDCO agreed on a definition of the high-tech industry based on the North American Industry Classification System (NAICS) codes. Our definition is based on a common definition

used by the U.S. Bureau of Labor Statistics (BLS). The definition includes the following industry sector NAICS codes.

Table 3-11. NAICS-based High-Tech Industry Definition

NAICS code	Industry
3254	Pharmaceutical and medicine manufacturing
3341	Computer and peripheral equipment manufacturing
3342	Communications equipment manufacturing
3344	Semiconductor and other electronic component manufacturing
3345	Navigational, measuring, electromedical, and control instruments manufacturing
3364	Aerospace product and parts manufacturing
5112	Software publishers
5161	Internet publishing and broadcasting
5179	Other telecommunications
5181	Internet service providers and Web search portals
5182	Data processing, hosting, and related services
5413	Architectural, engineering, and related services
5415	Computer systems design and related services
5417	Scientific research-and-development services
5416	Management, scientific, and technical consulting services

High-Tech Industry Presence in Maryland

Using the definition above, data was gathered on employment, establishments, and wages for each industry sector as well as the high-tech industry as a whole. **Table 3-12** shows this data below. As a whole, the high-tech industry in Maryland had over 15,000 establishments employing almost 200,000 in 2006. The average annual pay for high-tech industries was almost $75,000, more than 60% higher than the state's average annual pay of about $46,000.

Table 3-12. Maryland High-Tech Industry Data: 2006

NAICS Description	NAICS code	Establishments	Employment	Average Annual Pay
Pharmaceutical and medicine manufacturing	3254	61	5,536	$81,023
Computer and peripheral equipment manufacturing	3341	25	ND	ND
Communications equipment manufacturing	3342	67	5,592	$86,929
Semiconductor and other electronic component manufacturing	3344	65	2,277	$49,756
Navigational, measuring, electromedical, and control instruments manufacturing	3345	130	10,593	$93,195
Aerospace product and parts manufacturing	3364	33	4,555	$65,760

NAICS Description	NAICS code	Establishments	Employment	Average Annual Pay
Software publishers	5112	205	1,665	$99,603
Internet publishing and broadcasting	5161	73	656	$76,274
Other telecommunications	5179	29	164	$69,562
Internet service providers and Web search portals	5181	247	2,018	$80,286
Data processing, hosting, and related services	5182	315	4,871	$65,833
Architectural, engineering, and related services	5413	2,728	42,741	$73,425
Computer systems design and related services	5415	5,397	56,224	$68,926
Scientific research-and-development services	5416	5,078	28,771	$61,170
Management, scientific, and technical consulting services	5417	944	34,047	$75,421
Total High-Tech Maryland Industries		**15,397**	**199,710**	**$74,797**
All Maryland Industries		162,619	2,530,117	$46,157

Source: U.S. Bureau of Labor Statistics
Note: ND indicates data not disclosed.

Using the above data and equivalent data for the United States, an economic development technique called the location quotient was used to measure the magnitude of industry activity in Maryland compared to the United States. This measure is useful to help identify industries that are concentrated in Maryland and to assess whether Maryland has a relatively high concentration in the high-tech industry or its sub-sectors. The location quotients are shown in **Table 3-13**.

Table 3-13. High-Tech Industry 2006 Maryland Location Quotients

NAICS Description	NAICS Code	Location Quotient
Pharmaceutical and medicine manufacturing	3254	1.01
Computer and peripheral equipment manufacturing	3341	ND
Communications equipment manufacturing	3342	**2.06**
Semiconductor and other electronic component manufacturing	3344	0.26
Navigational, measuring, electromedical, and control instruments manufacturing	3345	1.29
Aerospace product and parts manufacturing	3364	0.51
Software publishers	5112	0.36
Internet publishing and broadcasting	5161	1.00
Other telecommunications	5179	1.32
Internet service providers and Web search portals	5181	0.89

NAICS Description	NAICS Code	Location Quotient
Data processing, hosting, and related services	5182	0.97
Architectural, engineering, and related services	5413	1.64
Computer systems design and related services	5415	**2.33**
Scientific research-and-development services	5416	1.64
Management, scientific, and technical consulting services	5417	**3.01**
Total High-Tech		**1.54**

Source: RTI analysis of U.S. Bureau of Labor Statistics data
Note: ND indicates data not disclosed.

By definition, a location quotient (LQ) between 0.75 and 1.25 is interpreted to mean that employment in that industry represents the same share of total employment in Maryland as it does in the United States as a whole. An LQ below 0.75 indicates a low concentration of employment in that industry relative to the United States, and an LQ above 1.25 means that employment is more highly concentrated as compared to the country.

The high-tech industry in Maryland overall, has an LQ of 1.54, indicating that employment in high-tech industries is more highly concentrated than in the nation. Three sub-sectors, shown in bold, stand out as being the most highly concentrated high-tech industry sub-sectors in Maryland.[32] This finding is logical given Maryland's strong high-tech industry and presence of research centers and other technology generators.

Survey Results and Interview Themes: Additional Incubator Services Desired and Potential for New High-Tech Incubators

Another component of Maryland's potential for new technology incubators is the demand for incubator services that are not currently being provided. The incubator client survey explored this issue by asking clients about various incubator services that they may not have received and whether they wished the service had been provided. **Table 3-14** and **Table 3-15** show these results for current incubator clients and graduates, respectively.

[32] Note that the absolute value of a location quotient should not be interpreted to represent an order of magnitude difference. For example, an LQ of 3 for industry X and 1.5 for industry Y does not necessarily mean that industry X is twice as concentrated as industry Y. LQ analysis is limited to the interpretation that industry X is more highly concentrated than industry Y, but cannot confidently quantify the magnitude by which it is more highly concentrated.

Table 3-14. Current Clients: Services/Facilities Not Provided by Incubator—Do You Wish It Had Been Provided?

Service/Facility	Yes	Don't Care	NA/It was Provided
Legal clinic/assistance	40	20	39
Connections with funding sources	39	10	50
Training programs/workshops	30	11	58
Individualized business counseling	33	12	54
Access to mentors and professional service providers	37	12	50
Networking among incubator companies	27	9	63
Shared office facilities	26	4	69
Shared biotech equipment	10	34	55
Shared biotech equipment, biotech companies only	7	1	11
Space that is functional, affordable, flexible terms	32	2	65
Access to university intellectual property/tech transfer office	33	14	52

Table 3-15. Graduates: Services/Facilities Not Provided by Incubator—Do You Wish It Had Been Provided?

Service/Facility	Yes	Don't Care	NA/It was Provided
Legal clinic/assistance	9	10	13
Connections with funding sources	11	2	19
Training programs/workshops	9	4	19
Individualized business counseling	11	6	15
Access to mentors and professional service providers	14	3	15
Networking among incubator companies	10	4	18
Shared office facilities	10	4	18
Shared biotech equipment	3	10	19
Shared biotech equipment, biotech companies only	2	1	8
Space that is functional, affordable, flexible terms	14	1	17
Access to university intellectual property/tech transfer office	8	7	17

Survey respondents to whom the service was not provided indicated whether they wished the service had been provided to them. For most of the services listed, more than 70% of respondents to whom the services were not provided indicated that they wished it had been provided. Generally, the services most desired were connections to funding sources, access to mentors and service providers, shared office facilities, and affordable, functional space. Additionally, while clients were not interested overall in shared biotech equipment, biotech companies when viewed separately were very interested in shared biotech equipment.

Incubator client focus group discussions confirmed that there is a strong demand for a variety of services clients are not currently receiving. Access to and assistance with securing funding was clearly the service most desired by clients. Specifically, clients wanted assistance with securing venture capital, connecting with angel investors, and securing gap funding. Other desired services that recurred repeatedly in focus group discussions were public relations and marketing assistance, human resources and recruiting support, and sensitive compartmented information facilities (SCIFs).

A final service demanded by incubator clients that was often mentioned in focus groups was individualized business counseling from experienced entrepreneurs. A number of companies mentioned that many general business seminars offered by the incubator were often not relevant to them. They felt that the resources used to provide these seminars might be better channeled into providing individual business counseling to companies to address the particular issues facing diverse companies at various stages of business development. This is interesting when viewed in conjunction with the previously discussed result from incubator manager interviews—managers thought that the most important service they were currently providing was one-on-one business counseling. While business counseling services that were being provided were appreciated by companies, they are not as effective as companies want them to be. The main issue here seems to be tailoring; business counseling and mentoring resources need to be closely tailored to the development stage of the company in order to maximize their value.

Interviews with incubator managers and stakeholders revealed a desire to provide services similar to those focused on by incubator clients. As with the incubator clients, manager and stakeholders overwhelmingly felt that access to capital was the most important service they would like to provide. Multiple managers expressed a desire to have an in-house venture capital firm or representative. Managers and stakeholders alike also focused on the need for angel funding and wished to develop more effective angel networks. Finally, the interviewees felt that in addition to increasing the amount of funding available, it was important to more effectively connect companies to existing venture capital, angel, and other funding. A second service that managers wanted to

provide was additional assistance with marketing and business development, which was also in agreement with the services clients desired.

The final interview topic relevant to the potential for new high-tech incubators was political support. As discussed previously, interviewees were almost unanimously positive in their perceptions of political support for incubation in Maryland. The only problematic issue pertaining to political support is a need for more support for incubator operating capital.

3.4.1 Conclusions: Potential for New High-Tech Incubators

While our findings from data analysis, client surveys, and interviews do not constitute a feasibility study for new high-tech incubators in Maryland, these findings are useful as a supplement to the established and effective feasibility study process that TEDCO has in place for the technology incubators it funds.

The data analysis indicates that Maryland has a strong concentration of high-tech employment relative to the United States. Furthermore, high-tech jobs pay an average wage more than 60% higher than the average wage for the state. Maryland also has a very strong technology economy, with every indication that it will continue to be successful. These findings in conjunction with Maryland's rich landscape of research centers and other technology generators indicate that the state has a strong foundation for additional technology incubators.

Many of the stakeholders interviewed said that there was strong political support for incubation in Maryland, which is also an important factor in concluding that the state does have potential for new high-tech incubators. According to our interviewees, Maryland's support for incubation covers the spectrum from state support to county and municipality support. Many incubators receive funding from their counties and municipalities in addition to the support they receive from TEDCO. However, some stakeholders noted that while political support was strong, financial support from the state had dropped in recent years. A stakeholder interviewed said that "there is just not enough resources to support incubator programs. The state has really dropped the ball when it comes to funding incubators." Another interviewee stated that political support was there "until the incubators need operating money."

Finally, there is an evident demand for new and expanded services by incubator clients. Interviewees and incubator clients all felt that addressing funding issues was a paramount need. Strong demand for and desire to provide additional services indicate that the current technology incubators are unable to provide all the services and assistance they would like because of their limited resources. New technology incubators could help to

strengthen the incubator network and provide additional capacity, allowing incubators to focus more of their resources on providing funding assistance to clients.

3.5 Potential for Niche Incubators: Regenerative Medicine and Alternative Energy

In addition to researching Maryland's potential for new general high-tech incubators, RTI also investigated the potential for niche incubators using two industries, regenerative medicine and alternative energy, as examples to explore their potential in the state.

The regenerative medicine industry, often based on and referred to as stem cell research, is scientifically and politically complex. An in-depth review of the stem cell industry is beyond the scope of this report; however, it is interesting to note that stem cell is one of the few biomedical research areas that is seeing more action at the state level than at the federal level, given the current ideological deadlock in the federal administration.[33]

Alternative energy, also referred to as renewable energy, is another multifaceted industry that encompasses a variety of sub-industries. Renewable energy resources are those that are naturally replenished in a relatively short period of time. They include biomass, hydropower, geothermal energy, wind energy, and solar energy. In 2005, about 6% of all energy consumed, and about 9% of total electricity production, was from renewable energy sources.[34]

Relevant Research Centers

Maryland has a wealth of research centers and technology generators that perform research in a wide variety of industries and disciplines. The state's research centers were discussed earlier in this report; however, a few are of note specifically in relation to the example niche incubator industries RTI researched.

The Henry A. Wallace Beltsville Agricultural Research Center (BARC), a part of the U.S. Department of Agriculture, is located in Beltsville, MD, and is performing extensive research on alternative energy. Their research is focused on the future of alternative energy and in developing new, more efficient alternative energy sources and methods.

The National Institutes of Health (NIH) has its headquarters in Bethesda, MD. The NIH is one of the world's foremost medical research centers and is the primary federal agency for conducting and supporting medical research. The NIH Intramural Research Program has created the NIH Stem Cell Unit to have a side-by-side comparison of the available human embryonic stem cell lines on the NIH Human Embryonic Stem Cell Registry.

[33] Rockefeller Institute Policy Brief, "Federalism by Necessity: State and Private Support for Human Embryonic Stem Cell Research." August 2007.

[34] US Energy Information Administration, http://www.eia.doe.gov/basics/renewalt_basics.html

Maryland universities also have research centers relevant to these niche industries. The Institute for Cell Engineering, at Johns Hopkins University provides an academic infrastructure and environment to accelerate the pace of discovery in a variety of stem cell-related fields.

Public Programs

Maryland currently has a variety of public programs and initiatives supporting stem cell research and alternative energy development. The Maryland Energy Administration (MEA) has a wide variety of programs that focus on renewable energy. The MEA itself is collaborating with other agencies, such as the Maryland Department of Agriculture and the Natural Resources Conservation Service, to develop technologies in alternative energy, including wind power and biomass. Other programs include demonstration projects for alternative energy-fueled schools, feasibility studies, and grants and tax credits for wind power, solar power, and geothermal heat pumps.[35]

Maryland is also strongly supporting stem cell research. A $15 million Maryland Stem Cell Research Fund, administered by TEDCO, was established in fiscal year 2007 to promote state-funded stem cell research by public and private entities in the state. During the first grant round, TEDCO received 85 applications for funding, requesting about $80 million in funding. In response to this demand, the state's approved fiscal year 2008 budget includes $23 million for the fund, a 66% increase over the previous year.

NAICS-based Industry Definitions: Proxies for Niche Industries

Earlier in this report, we used a NAICS code definition of the high-tech industry to examine its concentration in Maryland. To determine the concentration of the regenerative medicine and alternative energy industries, the same methods are necessary. However, NAICS codes are limited in that while they are useful for examining traditional, established industries, they are not always as applicable to emerging industries. No NAICS codes specifically describe the alternative energy or regenerative medicine industries. This issue requires us to use a proxy to represent and analyze these industries. These industry proxies are shown in **Table 3-16** and **Table 3-17**.

Table 3-16. Regenerative Medicine Proxy NAICS – Health, Biosciences, and Life Sciences

NAICS code	Industry
32518	Other Basic Inorganic Chemical Manufacturing
32519	Other Basic Organic Chemical Manufacturing
3254	Pharmaceutical and Medicine Manufacturing
333314	Optical Instruments and Lens Manufacturing
334516	Analytical Laboratory Instrument Manufacturing

[35] More information about the MEA's Renewable Energy Programs can be found at http://www.energy.state.md.us/programs/renewable/index.html.

NAICS code	Industry
334517	Irradiation Apparatus Manufacturing
3391	Medical Equipment and Supplies Manufacturing
524114	Direct Health and Medical Insurance Carriers
54138	Testing Laboratories
54169	Other Scientific and Technical Consulting Services
5417	Scientific Research & Development Services
6214	Outpatient Care Centers
6215	Medical and Diagnostic Laboratories
6219	Other Ambulatory Health Care Services
6221	General Medical and Surgical Hospitals

Table 3-17. Alternative Energy Proxy NAICS – Energy

NAICS code	Industry
21111	Oil and Gas Extraction
21211	Coal Mining
21311	Support Activities for Mining
22111	Electric Power Generation
31122	Starch and Vegetable Fats and Oils Manufacturing (bio-fuels)
32411	Petroleum Refineries
33591	Battery Manufacturing
212291	Uranium-Radium-Vanadium Ore Mining
221112	Fossil Fuel Electric Power Generation
221119	Other Electric Power Generation
221121	Electric Bulk Power Transmission and Control
221210	Natural Gas Distribution
324199	All Other Petroleum and Coal Products Manufacturing
325193	Ethyl Alcohol Manufacturing (ethanol)
333411	Air Purification Equipment Manufacturing
541330	Engineering Services

To approximate the regenerative medicine industry, a set of NAICS codes for the health, biosciences, and life sciences industries was used. The energy industry served as a proxy for the alternative energy industry. These proxies are more inclusive of other industry activities that relate to the niche industries. The industries included in the proxy definitions are related to the niche industries directly, or use similar resources and workforce skills, which indicates capacity for the example niche industries themselves.

Concentration of Example Niche Industries in Maryland

The NAICS-based proxy definitions allow us to gather data on employment, establishments, and wages for each industry sector as well as the niche industries as a whole. **Table 3-18** and **Table 3-19** show this data.

As a whole, the regenerative medicine proxy industry in Maryland had almost 3,000 establishments employing over 160,000 in 2006. The average annual pay for regenerative medicine proxy industries was almost $65,000, more than 40% higher than the state's average annual pay of about $46,000.

Table 3-18. Maryland Regenerative Medicine Proxy Data: 2006

NAICS Description	NAICS code	Establishments	Employment	Average Annual Pay
Other Basic Inorganic Chemical Manufacturing	32518	14	746	$86,487
Other Basic Organic Chemical Manufacturing	32519	5	ND	ND
Pharmaceutical and Medicine Manufacturing	3254	61	5,536	$81,023
Optical Instruments and Lens Manufacturing	333314	4	ND	ND
Analytical Laboratory Instrument Manufacturing	334516	21	547	$68,016
Irradiation Apparatus Manufacturing	334517	2	ND	ND
Medical Equipment and Supplies Manufacturing	3391	193	2,281	$48,947
Direct Health and Medical Insurance Carriers	524114	118	5,730	$66,242
Testing Laboratories	54138	157	2,241	$54,709
Other Scientific and Technical Consulting Services	54169	411	2,578	$85,149
Scientific Research & Development Services	5417	944	34,047	$75,421
Outpatient Care Centers	6214	475	10,975	$52,441
Medical and Diagnostic Laboratories	6215	267	3,611	$56,075
Other Ambulatory Health Care Services	6219	138	3,158	$39,189
General Medical and Surgical Hospitals	6221	75	92,035	$61,146
Total Regenerative Medicine Proxy Maryland Industries		**2,885**	**163,485**	**$64,570**
All Maryland Industries		162,619	2,530,117	$46,157

Source: U.S. Bureau of Labor Statistics
Note: ND indicates data not disclosed.

The alternative energy proxy industry in Maryland had about 1,600 establishments employing over 40,000 in 2006. The average annual pay for alternative energy proxy industries was almost $80,000, more than 70% higher than the state's average annual pay.

Table 3-19. Maryland Alternative Energy Proxy Data: 2006

NAICS Description	NAICS code	Establishments	Employment	Average Annual Pay
Oil and Gas Extraction	21111	4	3	$40,900
Coal Mining	21211	8	248	$49,751
Uranium-Radium-Vanadium Ore Mining	212291	0	0	NA
Support Activities for Mining	21311	31	436	$46,116
Electric Power Generation	22111	21	2,967	$120,753
Fossil Fuel Electric Power Generation	221112	6	1,689	$140,378
Other Electric Power Generation	221119	9	181	$94,716

NAICS Description	NAICS code	Establishments	Employment	Average Annual Pay
Electric Bulk Power Transmission and Control	221121	7	913	$70,650
Natural Gas Distribution	221210	17	683	$64,144
Starch and Vegetable Fats and Oils Manufacturing (bio-fuels)	31122	1	ND	ND
Petroleum Refineries	32411	13	ND	ND
All Other Petroleum and Coal Products Manufacturing	324199	0	0	NA
Ethyl Alcohol Manufacturing (ethanol)	325193	0	0	NA
Air Purification Equipment Manufacturing	333411	8	ND	ND
Battery Manufacturing	33591	3	ND	ND
Engineering Services	541330	1,509	32,989	$75,265
Total Alternative Energy Proxy Maryland Industries		**1637**	**40109**	**$78,075**
All Maryland Industries		162619	2530117	$46,157

Source: U.S. Bureau of Labor Statistics
Note: ND indicates data not disclosed.

Using the above data and equivalent data for the United States, a location quotient analysis was performed to measure the magnitude of industry activity in Maryland compared to the United States. As discussed previously, this measure can help identify industries that are highly concentrated in Maryland and to assess whether Maryland has a relatively high concentration in the niche industries or their sub-sectors. The location quotients are shown in **Tables 3-20** and **3-21**.

Table 3-20. Regenerative Medicine Proxy Industry 2006 Maryland Location Quotients

NAICS Description	NAICS Code	Location Quotient
Other Basic Inorganic Chemical Manufacturing	32518	0.95
Other Basic Organic Chemical Manufacturing	32519	ND
Pharmaceutical and Medicine Manufacturing	3254	1.01
Optical Instruments and Lens Manufacturing	333314	ND
Analytical Laboratory Instrument Manufacturing	334516	0.91
Irradiation Apparatus Manufacturing	334517	ND
Medical Equipment and Supplies Manufacturing	3391	0.39
Direct Health and Medical Insurance Carriers	524114	0.88
Testing Laboratories	54138	0.82
Other Scientific and Technical Consulting Services	54169	1.20
Scientific Research & Development Services	5417	**3.01**
Outpatient Care Centers	6214	1.18
Medical and Diagnostic Laboratories	6215	0.94
Other Ambulatory Health Care Services	6219	0.77
General Medical and Surgical Hospitals	6221	1.18

Total Regenerative Medicine Proxy Maryland Industries	**1.24**

Source: U.S. Bureau of Labor Statistics
Note: ND indicates data not disclosed.

As mentioned previously, a location quotient (LQ) between .75 and 1.25 can be interpreted to mean that employment in that industry represents the same share of total employment in Maryland as it does in the United States as a whole, while an LQ above 1.25 means that employment is more highly concentrated as compared to the United States.

The regenerative medicine proxy industry in Maryland, overall, has an LQ of 1.24, indicating that employment in these industries has a similar concentration in Maryland as in the overall United States. One sub-sector, scientific research and development services, stands out as being the most highly concentrated regenerative medicine industry sub-sector in Maryland. Because we are using a proxy definition for the regenerative medicine industry, the fact that the scientific research and development sub-sector is so highly concentrated may mean more than the overall industry's average concentration.

Table 3-21. Alternative Energy Proxy Industry 2006 Maryland Location Quotients

NAICS Description	NAICS Code	Location Quotient
Oil and Gas Extraction	21111	0.00
Coal Mining	21211	0.17
Uranium-Radium-Vanadium Ore Mining	212291	0.00
Support Activities for Mining	21311	0.09
Electric Power Generation	22111	0.66
Fossil Fuel Electric Power Generation	221112	0.66
Other Electric Power Generation	221119	1.08
Electric Bulk Power Transmission and Control	221121	**1.88**
Natural Gas Distribution	221210	0.34
Starch and Vegetable Fats and Oils Manufacturing (bio-fuels)	31122	ND
Petroleum Refineries	32411	ND
All Other Petroleum and Coal Products Manufacturing	324199	0.00
Ethyl Alcohol Manufacturing (ethanol)	325193	0.00
Air Purification Equipment Manufacturing	333411	ND
Battery Manufacturing	33591	ND
Engineering Services	541330	**2.00**
Total Alternative Energy Proxy Maryland Industries		**1.05**
Total excluding Engineering Services		**0.33**

Source: U.S. Bureau of Labor Statistics
Note: ND indicates data not disclosed.

The alternative energy proxy industry in Maryland, overall, has an LQ of 1.05, indicating that employment in these industries has a similar concentration in Maryland as in the overall United States. Two sub-sectors, shown in bold, stand out as being more highly concentrated in Maryland than the others are. A closer examination of the underlying data reveals that the engineering services sub-sector alone employs almost 33,000 in Maryland, while the next highest employment in a sub-sector is less than 3,000. It appears that the overall industry LQ is being driven almost entirely by this sub-sector; after removing this sub-sector from the analysis, the LQ drops sharply to .33, indicating a low concentration of alternative energy industries in the state.

To delve further into this issue, data on states' production of alternative energy were examined. In 2006, Maryland's production of alternative energy, measured in kilowatt-hours, ranked 29th in the United States.[36] These data further indicate that Maryland has a lower than average concentration of the alternative energy industry.

Interview Themes: Potential for New Niche Incubators

Interviewees were almost unanimous in their opinion of niche incubators—they were opposed to the concept. Specifically, most interviewees felt that the particular example industries of regenerative medicine and alternative energy were not strong enough to warrant a niche incubator, and they were also skeptical of the idea of a niche incubator in general.

A variety of reasons drove the skepticism. First, interviewees did not think there was a critical mass in either of these industries to warrant a niche incubator. Furthermore, they did not think there were enough companies to create the demand necessary to consistently fill a niche incubator over the long-term. Secondly, the general feeling was that a niche incubator would be too risky. Industry trends change and it is important to maintain a level of diversity to insulate an incubator from this risk rather than "putting all your eggs in one basket." On a more practical level, interviewees were concerned that an exclusive niche incubator would miss out on opportunities to secure clients in a wider market. Finally, interviewees felt that one of the fundamental benefits incubator tenancy confers is the knowledge sharing that results from tenants co-locating with diverse companies. In a niche incubator, tenants would not be exposed to as much diversity, likely diluting this benefit.

While most interviewees echoed these themes, a few thought that niche incubators were a good idea. The reasons cited were that they would be an effective tool for marketing and branding for the state or region as a "hot spot" for industries such as alternative energy or regenerative medicine.

[36] US Energy Information Administration, http://www.eia.doe.gov/fuelrenewable.html

Many of the interviewees who did not necessarily favor niche incubators did see an alternative method of promoting alternative energy and regenerative medicine through the incubation system. Rather than creating an incubator with an exclusive focus on a specific niche industry, centers of excellence or focus areas in niche industries could be created at existing or new technology incubators. These incubators would be open to a wider variety of small technology companies, but would have focused efforts on a niche industry and could be marketed and branded as such.

3.5.1 Conclusions: Potential for New Niche Incubators

While providing a definitive answer on whether Maryland can or should invest in niche incubators is beyond the scope of this report, it is possible to comment on the circumstances in which such an incubator would exist.

There is no doubt that Maryland has an impressive wealth of research centers and technology generators in these example industries as well as a variety of others. The state has been clear in its support of both alternative energy and regenerative medicine through its increasing investments in providing grants, tax credits, and research funding programs.

The counterargument here rests on the state's current industry concentrations in these industries. Alternative energy industries generally are not at all concentrated in Maryland when compared to the United States. Regenerative medicine industries are somewhat more concentrated, but this is not consistent across sub-sectors. Furthermore, our interviews with incubator managers and stakeholders, who collectively constitute a vast pool of knowledge concerning technology incubators, revealed widespread skepticism toward the idea of niche incubators in any industry, not just those investigated in this report.

This mix of factors both for and against niche incubators does not leave us with a clear indication about the state's ability to invest in niche incubators in these industries and the wisdom of such a move. The common interview theme of establishing focus areas as an alternative to niche incubators seems to make the most sense given the information available. Establishing centers of excellence in regenerative medicine and alternative energy at existing or new incubators that support technology companies more generally would allow the state to enter into the realm of niche incubators in a more gradual way. These focus areas would be flexible, and could possibly expand into niche incubators if a critical mass of demand from companies is reached. On the other hand, if these niche industries experience a slump, like the tech bust of the early 2000s, the incubators would still have clients in other industries and could scale back their investments in niche focus areas as necessary.

4. Assisting Maryland Incubator Graduates

Graduates of technology business incubators face similar barriers to success as other small businesses; however, in this section we explore these issues along with the particular barriers business incubator graduates face. These issues are explored through a brief literature review, a description of approaches for assisting incubator graduates, specific findings for Maryland from interviews and survey results, and suggested options available for TEDCO to assist graduates and ensure greater small technology business success overall.

4.1 Literature Review on Business Development Support

To date, there is limited research of specific best practices to assist incubator graduate companies. As Russ Price at Utah State University noted, "Whereas business incubator facilities focus resources on 'hatching' new technology-based businesses, the equally substantial need for maturing existing businesses in their formative years has received less attention."[37] Due to this limitation, this section will focus on providing an overview of business development support and supplement this with findings from surveys and interviews to guide the direction of suggested best practices for graduate companies within the state.

Business Development Support Services

A common set of business development support services is provided by incubators and other small business service providers. This includes, but is not limited to[38]

- Flexible rental space
- Flexible leases
- Shared administrative services
- Shared equipment
- Access to business advisors: finance, business planning
- Access to technical advisors: marketing, legal consulting, manufacturing

While these services are for businesses within incubators, not necessarily graduate companies, they lay a groundwork from which services that are more specific can be assessed. For example, a research paper examining strategies from European research institutions looks closely at the institution's role in the "spin-out" process and finds six

[37] Russ Price. 2004. "The Role of Service Providers in Establishing Networked Regional Business Accelerators in Utah." *International Journal of Technology Management*. Vol. 27, No. 5, 2004. p.465-474.

[38] Peters. Lois; Rice, Mark; and Malavika Sundararajan. 2004. "The Role of Incubators in the Entrepreneurial Process." *Journal of Technology Transfer*. 29, 83-91, 2004.

phases of business development, starting with the identification of technologies with commercial potential to securing venture financing for the product. During this process of business change, the authors note that a gap in resources can retard business growth and suggest that institution managers must pay particular attention with regard to each company's stage of growth when considering service provision. They state, "Deficiencies in the initial resource endowments of spin-outs constrain the new venture's development and may be further exacerbated by an un-entrepreneurial environment. From a resource-based perspective, spin-outs need to develop their resources over time if they are to progress through the different phases of development and create significant wealth."[39] In other words, it is important to consider applying business assistance resources across the business development cycle to ensure success.

Susan Walcott addresses this issue from a slightly different perspective. In her research on innovation environments in the biosciences, she details factors crucial for the development of a bioscience cluster, ranging from an outstanding research university to local entrepreneurial culture to advocacy and leadership. One factor relevant for incubator graduates in the biosciences, she notes, is "a supply of real estate available for the three corporate growth stages of start-up, initial self-supporting quarters and full-fledged operations." She further explains that "Bioscience work involves 'messy' media, such as blood and tissues, so companies need specially configured laboratories that are less interchangeable than general office space or even 'cleaner' high-tech companies dealing principally with wires and computers. Developers must be willing to build such facilities on a speculative basis, given the high failure rate of fledgling enterprises. They are more willing to do so if a critical mass of such companies creates a steady demand for these units."[40]

This is relevant for Maryland because a significant portion of the incubator clients surveyed and interviewed are in the bioscience industry sector, and these companies were very vocal about their inability to access wet lab space as their main barrier to success upon graduation from the incubators.

With the understanding of the need to assist businesses as they develop over time, and to tailor assistance in conjunction with their particular stage of growth and industry type, RTI further explores approaches for assisting incubator graduates by examining specific findings from incubator tenants, graduates, and interviews with other incubator stakeholders.

[39] Clarysse, Bart; Wright, Mike; Lockett, Andy; Van de Velde, Els; and Ajay Vohora. 2004. "Spinning out new ventures: A Typology of Incubation Strategies from European Research Institutions." *Journal of Business Venturing* Vol. 20, Issue 2, March 2005, pages 183-216.

[40] Susan M. Walcott. 2002. "Analyzing an Innovative Environment: San Diego as a Bioscience Beachhead." *Economic Development Quarterly*. Vol 16 No. 2, May 2002 99-114.

4.2 Approaches to Assisting Graduates

Through a comprehensive survey of current and graduate incubator clients and interviews with clients, managers, and stakeholders, RTI was able to more closely determine particular needs for incubator graduates in the state. These findings are summarized below.

Interview Themes and Findings for Maryland

Survey Findings

The survey responses demonstrate that the need for customizable, affordable space is the most pressing barrier for graduate companies, particularly for biotech and IT companies. This makes sense given that companies in these industries require more demanding and complex physical infrastructure to operate. In **Table 4-1**, current incubator clients rated reduced-rent office space as the most important post-incubator service that could be provided upon gradation. Understanding that IT and biotech companies have particular needs, RTI separated their responses for analysis and found that for biotech companies, the need for wet lab facilities received the highest ranking of 3.1. In contrast, when all respondents were asked this question, the need only scored 0.8. This is due to the fact that only a portion of statewide incubator clients depend on this resource for business development. Other needed services receiving high ratings are networking with other companies and customizable space for IT companies. Each rated a 2.7.

Table 4-1. Current Clients: Most Important Post-Incubator Services and Facilities Upon Graduation

Service/Facility	Mean Rating (0–4 scale)
Reduced-rent office space	3.0
Networking with other companies	2.7
Access to trained workforce	2.6
Assistance with raising equity capital	2.6
Business development assistance	2.4
Management skill development	2.4
General business mentoring	2.1
Customizable, affordable IT space	2.0
Customizable, affordable IT space, IT companies only	2.7
Loans for fitting out space	2.0
Wet lab facilities	0.8
Wet lab facilities, biotech companies only	3.1

Service/Facility	Mean Rating (0–4 scale)
Customizable, affordable biotech space	0.8
Customizable, affordable biotech space, biotech companies only	3.0

When this same question was asked of graduates, the findings were similar if not a little more pronounced, as shown in **Table 4-2**. The highest ranking came from biotech companies, in particular citing the need for customizable affordable space as very important (3.7 out of 4.0) and the need for wet lab space following close behind (3.4 out of 4.0). All respondents ranked the need for reduced rent office space and access to a trained workforce as important (3.1 out of 4.0). Again, IT graduate companies mentioned the need for affordable customizable space as an important service (3.0 out of 4.0).

It is important to note that the survey captured only successful graduate companies. RTI, in conjunction with its partners in Maryland, was unable to locate and secure responses from failed companies. This skews these findings to representing needs of successful companies.

Table 4-2. Graduates: Most Important Post-Incubator Services and Facilities

Service/Facility	Mean Rating (0–4 scale, 4 is extremely important)
Access to trained workforce	3.1
Reduced-rent office space	3.1
Networking with other companies	2.5
Loans for fitting out space	2.1
Management skill development	2.1
Business development assistance	2.0
Customizable, affordable IT space	2.0
Customizable, affordable IT space, IT companies only	3.0
Assistance with raising equity capital	2.0
General business mentoring	1.9
Wet lab facilities	1.6
Wet lab facilities, biotech companies only	3.4
Customizable, affordable biotech space	1.4
Customizable, affordable biotech space, biotech companies only	3.7

When current clients were asked what they foresaw as barriers to graduation, it is striking to note, overall, that none of the particular barriers ranked much over the average score of 2.0 (see **Table 4-3**). Lack of affordable space was rated the highest at 2.2 out of 4.0, and business climate and market conditions were next at 2.1. This reflects a similar reaction from most incubator company interviewees. When current clients were asked about graduation, most would reply that they have so many other obstacles between now and then that they had a hard time knowing what those barriers may be. Other replies included that they hoped to be purchased by then, or to be so successful that they did not need further assistance. In short, responses were limited because concerns about this stage of business development were not prominent on their radar.

Table 4-3. Current Clients: Most Serious Barriers to Success Upon Graduation

Barrier	Mean Rating (0–4 scale, 4 is extremely serious)
Lack of affordable space	2.2
Business climate/market	2.1
Lack of equity funding	2.0
Lack of trained workforce	1.9
Lack of appropriate space	1.7
Lack of public grant funds	1.6
Lack of business expertise	1.4
Access to clinical trials	0.5

As **Table 4-4** illustrates, the graduates surveyed did not report any serious barriers to success. However, as mentioned earlier, only successful graduates responded to the survey, so these findings reflect their successes.

Table 4-4. Graduates: Most Serious Barriers to Success

Barrier	Mean Rating (0–4 scale, 4 is extremely serious)
Lack of public grant funds	1.5
Business climate/market	1.5
Lack of trained workforce	1.5
Lack of equity funding	1.4
Lack of business expertise	1.4
Lack of affordable space	1.3

Barrier	Mean Rating (0–4 scale, 4 is extremely serious)
Lack of appropriate space	1.1
Access to clinical trials	0.6

Most graduates use the resources of the Maryland Department of Business & Economic Development (DBED) more than any other service provider, as shown in **Table 4-5**. Other services used by graduates include MIPS and Technology Councils in the State.

Table 4-5. Graduates: Other Services and Resources—Have You Utilized These Resources?

	Yes	No
Maryland Department of Business & Economic Development (DBED)	22	8
Maryland Technology Enterprise Institute (MTECH)	2	28
Small Business Development Centers (SBDC)	3	27
Maryland Industrial Partnerships Program (MIPS)	10	20
Technology councils in the state	8	22
Manufacturing Extension Partnership (MEP)	0	30
Technology Transfer Office	4	26

Interview Themes

Focus groups and interviews with business incubator clients and other stakeholders also provided insight into potential services for graduates. For the most part, incubator clients mentioned five items they thought would be helpful after graduation. As mentioned earlier, it is important to remember that many interviewees felt that graduation was so far removed from the pressing needs of the present, they had a hard time determining what their business would look like at that point and what kinds of services they would need. That said, the following common needs emerged from these discussions. They are in order of importance, noted by frequency and emphasis each item was given during the interviews.

1. Space

As noted above, finding affordable and flexible space after graduation was a concern for tenants. Biotech companies were emphatic that space was a big issue for them. They mentioned that other space was available but it was too expensive or required too much commitment for a lease at the outset. These companies are not stable enough yet to be

able to determine their lab needs for a year, and having space that is flexible is key to helping them keep costs down. It was suggested that "one incubator be created that graduates can feed into." However, they were unclear on the best place to locate such a facility. As one business owner said, "A mezzanine stage incubator would be an ideal place to go. Building your own lab space stinks." Others said, "We want an incubator B. We are willing to pay more but we want better services." Other space needs were affordable space conducive to IT. In particular, it was mentioned that SCIF space is needed for small businesses contracting with federal agencies. For a single business this secure space is very expensive, but shared, it could be an affordable benefit to many. Other space concerns were mostly finding affordable office space in the metro regions.

2. Access to Capital

Above all, the need for angel and venture funding was a constant need noted by incubator managers, clients, and other stakeholders. Gap financing was also a constant concern, even as they thought about graduation. It was also stated that making gap financing easier to access would be a huge improvement for companies. A client noted, "Applying for state funding isn't hard, it's getting through the hoops of the bureaucrats." Clients also thought they could be served better after graduation if state service providers were better coordinated. Often getting a grant from one agency did not resonate with another state agency, adding additional burden to the business owner.

3. Manufacturing Assistance

A less common need was mentioned by two business owners who were very disappointed in the lack of manufacturing assistance in Maryland, and foresaw this as a continuing concern as they graduated. Support for high-tech manufacturing design, prototype development, and production is not common in the state. They thought this a missing link that would be a key factor in their business success and a source for translating their technology businesses into jobs for Maryland workers in the years to come.

4. Business Assistance

A few of those interviewed mentioned that business support services such as counseling, budgeting, financing, and marketing would be helpful. In particular, one client mentioned assistance calculating projected overhead costs would be useful as he considered graduation.

5. Marketing for Incubator Organizations

One final perspective from clients was that they thought the incubators and support organizations could do a better job of marketing themselves to venture capitalists and angel networks. They believed this could create a cache for businesses that have come

from incubators or received support and thus help communicate a strong track record to potential investors.

A handful of others interviewed did express that TEDCO is very good at what it does, and should continue doing it. Along the same lines, some thought that graduation was itself a success, and "there is a point where public programs have done what they can do and it's time for them to stop expanding services."

4.3 Options to Pursue

Given the academic literature, survey results, and findings from interviews, it seems that as Maryland's leaders seek to assist incubator graduates, the best option is to address the issue of post-graduation space.

In conjunction with TEDCO, RTI chose to research two particular ways to address this issue:

1. Create a business accelerator or mezzanine space in which graduates can locate.
2. Assist companies with fitting out their own space with individual grants or loans.

4.3.1 Accelerators

The terms "business incubator" and "business accelerator" are often used interchangeably. For this document, RTI uses the term business accelerator to indicate a space for companies that have already been formed and have a well-defined business purpose.[41]

In the following paragraphs, we present an example of a comprehensive business accelerator in Pennsylvania. One of the reasons for construction of the Pennsylvania business accelerator was to address the growing demand for wet lab space for incubator graduates, similar to the conditions in Maryland.

Ben Franklin TechVentures, Bethlehem, PA[42]

TechVentures is a new high-tech workspace and community for early-stage companies. It is uniquely situated to meet the needs of emerging technology-oriented businesses, including the life sciences, and addresses the growing appetite for incubator space and affordable wet laboratory facilities in the Mid-Atlantic region.

Basic features:

Size: 35,000 square feet of rentable space

[41] Based on definitions from Russ Price. 2004. "The Role of Service Providers in establishing networked regional Business Accelerators in Utah." *International Journal of Technology Management*. P. 466.

[42] http://nep.benfranklin.org/cwo/Incubator_Network/?page_id=166

Space available: 6,800 square feet

Rentable sizes: 250 to 1,230 square feet

Wet lab space: 11,000+ square feet

Typical rent: $12 per square foot (office); $15 per square foot (lab)

Nature of space: High-tech office and wet lab space

Gas lines: yes

All wet labs include

Hooding and ventilation systems

Liquid chemical disposal systems

Chemical-resistant countertops and floor coverings

In-lab emergency showers

Lab connections available for installation of specialty gases

Centralized vacuum and compressed air lines

4.3.2 Funds for Customizing Space

RTI was unable to locate information on incubators or incubator associations currently developing grant funds or loans programs for companies to fit out their own space. While this method does not seem to be widespread, it is potentially a relatively efficient and cost-effective way to support graduates.

One potentially useful mechanism for providing funds to small business is a revolving loan fund or an RLF. An RLF is a fund from which a series of loans are made for small business development projects. RLFs are used in community and economic development projects to provide a source of financing, which may not otherwise be available within the community, for local, expanding, or start-up businesses.[43] The fund is typically capitalized with dollars that are not repaid. After a loan is made to a business and repayments return to the fund source, funds become available for new loans to other businesses.

These are options for TEDCO to pursue as they consider assisting incubator graduates in the state, particularly graduates requiring affordable and flexible wet lab space.

It is important to note that when companies were asked in the survey about these services, they indicated that they would prefer to have a mezzanine space or accelerator in which to locate.

[43] http://ohioline.osu.edu/cd-fact/1229.html

5. Summary of Findings and Implications for Maryland

Throughout this report, a number of important findings were discussed. These findings can also be viewed in conjunction with the additional insights gained from the client survey, secondary research, and interviews with clients, managers, and stakeholders. Considering these insights and findings from a holistic standpoint, a number of themes and implications common throughout the report stand out. Our summary of findings and the common themes and implications are discussed below.

5.1 Summary of Findings

1. The network of technology incubators in Maryland has experienced strong growth in recent years. The impact analysis conducted for TEDCO in 2000-2001 included six technology incubators and surveyed 125 current and past clients. In contrast, our study reviewed 18 technology incubators and surveyed close to 161 current and graduate incubator clients—revealing that the technology incubator network has grown to about three times its former size in about six years.

   Maryland's strong and growing technology incubator network has had a positive impact on the state's economy. The IMPLAN simulation shows that firms graduating from or occupying a technology incubator in Maryland increased state output by $2.7 billion per year and gross state product (e.g., labor, capital earnings, indirect business taxes) by $1.2 billion, with a significant portion of value-added increases resulting from a rise in labor income ($845 million). The associated total employment increases are estimated to be 14,044 full-time employees. State and local tax revenue increased by approximately $104 million per year. Additional comparisons of industry multipliers shows that incubator clients are associated with industries that generate a larger number of indirect economic benefits compared to other industries in the Maryland economy.

2. Clients of the technology incubators in Maryland have been very satisfied with the services they have been provided and highly value the resources and other benefits they have gained through their incubator experience. Clearly, clients felt that the affordable, functional, and flexible space provided by incubators, as well as the credibility afforded to companies by virtue of their incubator affiliation, was extremely important.

   While clients are happy with the services currently being provided, there is also a strong demand for additional services, especially those that would assist clients with accessing capital. Incubator managers also felt that they were providing valuable resources but they would like to provide additional services, especially those pertaining to capital access.

3. Maryland has good potential for additional technology incubators. The state's strong high-tech economy, wealth of research and technology generators, and high concentration of high-tech industries constitute a strong foundation on which additional technology incubators could be built. On the demand side, incubator clients and managers made it clear that additional incubator services could be very valuable for small technology businesses. New technology incubators could help to strengthen the incubator network and provide additional capacity for extra services.
4. In general, the potential for niche incubators in Maryland, using example niche areas such as regenerative medicine and alternative energy, is not clear. State support for these industries and the extensive list of research centers and technology generators in these and other technology industries supports the idea of niche incubators. On the other hand, these niche industries are not strongly concentrated in the state, and interviewees were clear in their view that niche incubators are unnecessarily risky and would have limited markets and little ability to respond to changing market conditions.

   Given these mixed results, no recommendation for or against niche incubators can be made. However, there is potential in the recurring idea that came up in interviews: establishing centers of excellence or focus areas in niche industries at more general technology incubators. This strategy would allow the state to try a scaled-down version of niche incubators that would be flexible enough to grow or shrink in response to market circumstances.
5. For some companies, graduation from an incubator poses problems that could potentially be addressed through several post-incubator programs. The two problems most applicable to technology incubator graduates in Maryland are affordable, flexible, and customizable space, and access to capital needs. The space issue could be addressed through either creating business accelerators or developing a fund to fit out lab and office facilities for incubator graduates. Addressing the capital issue is primarily about cultivating strong networks and linkages with the venture capital and angel funding communities.

5.2 Common Themes and Implications for Maryland

1. Client survey results and interviews with clients, managers, and stakeholders all had one thing in common—the incubation community has great appreciation and respect for the work TEDCO is doing. TEDCO was unanimously seen as a national leader in promoting and funding technology incubation.

   The quality and efficiency of TEDCO's services were also widely lauded; clients felt that "they are very fast and the process is extremely organized … TEDCO is

impeccable"; and perceived TEDCO to be "the number one seed funding [agency] in the country."

2. There appears to be some level of disconnect in certain areas between the perceptions of incubator managers and experiences of incubator clients. While incubator clients clearly felt that the space provided by incubators was the most important resource, managers often stated that the services they provided were the main benefit to clients, with space being secondary. Additionally, many clients also cited individualized business counseling as an important service they were not currently receiving, and that general business seminars were often not relevant to them. In contrast, managers felt that business counseling was an important service currently being effectively provided, and that business seminars were another important resource for clients.

   To address these differences in perception, it would be useful to more fully open the channels of communication between managers and clients. If the bottom-line goal of incubators is to help client companies succeed, it is important for limited incubator resources to be utilized in a way that is most helpful to clients. If managers and clients are communicating effectively, it will help to ensure the most efficient and effective use of these resources.

3. Access to capital is a ubiquitous problem for technology incubator clients and graduates. All groups of interviewees and focus group participants cited the availability of financing as a major hurdle for most technology incubator companies. This issue is complex and multi-faceted; it is also a national problem—venture capital and angel funding is focusing more on later-stage companies, creating a funding gap between small seed funds and angel or venture capital investment.

   Many interviewees felt that the relationship between funding from TEDCO and funding from DBED could be improved. Companies felt that securing funding from a TEDCO source should make it easier for them to access DBED funding, but currently it has no effect. They also felt that much of the available funding was disproportionately difficult to access in relation to the funding amounts; one stakeholder said "make this an easier process—don't make companies bleed for fifty thousand dollars."

   While state and TEDCO programs can only go so far in addressing a complex national problem, these programs can be made more effective. Programs should be marketed more heavily to increase awareness of funding availability, and funding criteria and restrictions should be examined to minimize burdensome administrative requirements and make funding easier for companies to take advantage of. Additionally, TEDCO and the state should consider better coordinating their funding programs to help companies access the full spectrum.

It is also worth considering additional funding mechanisms through the incubators themselves. Many managers have experienced difficulty in connecting companies to venture capital and angel funding sources. A program that brought capital firms and angels directly into the incubators, creating a venture capitalist- or angel-in-residence situation, may help address this problem. Managers also expressed interest in having a small pool of grant money in the incubators themselves to quickly provide client companies with small amounts of funding to meet immediate needs.

4. The final issue that ran throughout this report is the difficulty in accessing wet lab space. Life science companies overwhelmingly indicated that wet lab space provided by incubators was extremely important, and they desired help with accessing and affording such space upon graduation.

   To clarify this issue, most incubator managers and stakeholders acknowledged the problem companies have in accessing wet lab space, but they generally felt that the issue was not about a lack of lab space or the affordability of space. Indeed, a recent study reports that Montgomery County, which has the majority of Maryland's life science space, has a 14% vacancy rate in its life science inventory.[44] Rather, life science incubator graduates generally need space that is much smaller and more flexible than what is usually commercially available. Retrofitting appropriately sized, unequipped space with the proper life science equipment is often prohibitively expensive.

   Addressing this issue is no small task, but there are options that could help alleviate this problem. Given the academic literature, survey results, and interview findings, Maryland's leaders can assist incubator graduates with their space concerns through two mechanisms. First, they can create a business accelerator or mezzanine space for incubator graduates, but finding an accessible location that considers proximity to research universities and other location needs of more suburban incubator companies at an affordable cost will be a difficult balancing act. Finally, the technology-based economic development leadership can assist companies by providing grants or loans to help them fit out their own wet lab space.

[44] Grubb and Ellis, 2007. Report shared with RTI International by Pat Larrabee of Facility Logix.

Attachment A

Research Centers

Table A-1. University Research Centers[45]

Center Name	Industry	Type	City
MTECH	Technology-based Consulting	Associated with the University of Maryland	College Park
ERC CISST	Computer Integrated Surgical Systems	Johns Hopkins University	Baltimore
Applied Physics Laboratory	Physics Lab at Johns Hopkins University	Johns Hopkins University	Laurel
Whiting School of Engineering	Engineering School at Johns Hopkins University	Johns Hopkins University	Baltimore
Johns Hopkins Medicine	Medical Research	Johns Hopkins University	Baltimore
Institute for Cell Engineering	Medical Research – Stem Cell Research	Johns Hopkins University	Baltimore
Morgan State University	Engineering Department at Morgan State University	Morgan State University	Baltimore
University of Maryland Biotechnology Institute	Biotech Research	Nonprofit	Rockville
Maryland Nanocenter	Nanotechnology Research	Affiliated with the University of Maryland	College Park
A. James Clark School of Engineering	Engineering School at University of Maryland	University of Maryland	College Park
Center for Advanced Life Cycle Engineering	Engineering	University of Maryland	College Park
Intelligent Servosystems Laboratory	Security Systems Engineering	University of Maryland	College Park
Laboratory for Advanced Information Technology	Information Technology	University of Maryland	Baltimore
Human-Computer Interaction Lab	Information Technology	University of Maryland	Baltimore
Optical Fiber Communications Laboratory	Fiber Optics Research	University of Maryland	Baltimore
Space Systems Lab	Space Engineering	University of Maryland, also affiliated with NASA	College Park
Technology Center at UMBC	Technology Research	University of Maryland	Baltimore
Materials Research Science and Engineering Center	Materials Research	University of Maryland	College Park

[45] This is only a partial listing of research centers and is not meant to be comprehensive.

Table A-2. Non-University Research Centers[46]

Center Name	Industry	Type	City
National Institute of Health	Medical Research; Performs stem cell research	Government	Bethesda
Center for Biologics Evaluation and Research	Public Health	Government	Rockville
Center for Devices and Radiological Health	Radiological Testing	Government	Rockville
National Security Agency	National Security	Government	Fort Meade
National Naval Medical Center	Medical Research	Government, Medical Research	Bethesda
Naval Surface Warfare Center, Carderock Division	Advanced Materials Research for Military Applications	Government, Military Research	West Bethesda
Naval Surface Warfare Center, Indian Head Division	Energetics Research	Government, Military Research	Indian Head
Naval Air Warfare Center, Aircraft Division	Aircraft Research	Government, Military Research	Patuxent River
Army Research Laboratory, Aberdeen Proving Grounds	Military Research	Government, Military Research	Adelphi
Army Aberdeen Test Center	Military Research	Government, Military Research	Aberdeen Proving Ground
Center for Environmental Health Research	Military Research	Government, Military Research	Fort Detrick
Edgewood Chemical Biological Center	Military Research	Government, Military Research	Aberdeen Proving Ground
Goddard Space Flight Center	Space Transportation	Government, Space Exploration	Greenbelt
Advanced Technology Program	Research and Development in the areas of Chemistry, Life Sciences, Information Technology, and Electronics	Government, National Institute of Standards and Technology	Gaithersburg
Cystic Fibrosis Foundation	Medical Research concentrating on Cystic Fibrosis	Nonprofit	Baltimore

[46] This is only a partial listing of research centers and is not meant to be comprehensive.

Center Name	Industry	Type	City
Maryland Advanced Development Laboratory	Aviation, Computer Science, Atmospheric Physics, Electro-Optics, Digital Cartography, and Radar and Infrared Sensor Technology	Nonprofit; University Research Foundation	Greenbelt
Lockheed Martin Corporation	Aerospace Engineering	Publicly Traded Company	Bethesda
Digene Corporation	Medical Research specifically related to women	Publicly Traded Company	Gaithersburg
Ciena Corporation	Fiber Optics Research	Publicly Traded Company	Linthicum
Celera Group	Genomics Research	Publicly Traded Company	Rockville
Sonex Research, Inc	Automotive Engine Research; Performs alternative fuel testing	Publicly Traded Company	Annapolis
ATK Space Systems	Advanced Weapons and Space Systems	Publicly Traded Company	Elkton
The Henry A. Wallace Beltsville Agricultural Research Center	Agricultural Research	Government; Part of USDA Agricultural Research Service	Beltsville

Source: RTI

Attachment B

Quick Facts

Key Data Points Resulting From the Impact Analysis

Incubator Firms in 2006

- Employed 14,044 employees in the state (5,374 direct employees and 8,670 indirect employees)
- These jobs contributed $845 million in annual salary and benefits to Maryland households
- Gross state product contributions totaled $1.2 billion
- Increased state output by $2.7 billion per year
- Contributed $104 million in state and local taxes

TEDCO[a]

- For every $1 of incubator assistance funding provided by TEDCO, tenant companies contributed $1,800 dollars to Maryland's gross state product.
- TEDCO made an average investment of $120 per incubator company job in 2006.

Incubators in Maryland

- 18 technology incubators in operation comprising 453,061 square feet
- 4 proposed technology incubators

Future Implications

- Maryland has a strong high-tech industry, with over 15,000 establishments employing almost 200,000 in 2006. The average annual pay for high-tech jobs is $75,000, more than 60% higher than the statewide average annual wage of $46,000.
- The high-tech industry in Maryland overall has a location quotient of 1.54, indicating that employment in high-tech industries is more highly concentrated than in the nation. (An LQ between 0.75 and 1.25 is interpreted to mean that employment is the similar to the national average. An LQ above 1.25 indicates concentration).
- The three most concentrated industries are management, scientific, and technical consulting services (LQ= 3.01); computer systems design and related services (LQ = 2.33); and communications equipment manufacturing (LQ = 2.06).
- Academic R&D totaled $2,357 million in 2005. This is fourth highest in the nation and surpasses North Carolina, Massachusetts, and Virginia.
- There are over 40 research centers in Maryland, including a significant presence of federal labs and prominent university institutes.
- Taken together, these facts provide the state with a strong foundation for additional technology incubator growth.

This Study

- 359 incubator clients and graduates from 18 incubators supported by TEDCO were surveyed.
- The survey had an overall response rate of 45%.

[a] Approximately half of this value ($900) is directly associated with tenant companies, and the remaining $900 was generated through indirect impacts from the tenant companies' economic links with other Maryland industries and households.

A similar analysis could not be performed for graduate companies because of data limitations, but the tenant estimates provide the best available measure for new successful graduate firms. It is important to note that since this measure is restricted to a single year, it could understate funding/impact relationships for mature graduate firms that experience sales and employment growth over time. This figure includes only direct jobs within incubator client companies.

Attachment C

Investment Capital Firms

Maryland Investment Capital Firms

The following table lists Maryland Investment Capital firms mentioned in Section 2.

Table C-1. Maryland Venture Capital Firms[47]

Firm	City
Abell Venture Fund	Baltimore
ABS Capital Partners	Baltimore
Allegiance Capital Limited Partnership	Cockeysville
American Capital	Bethesda
Anthem Capital Management	Baltimore
Atapco Ventures	Baltimore
Atlantic Capital Group (ACG)	Baltimore
Beacon Global Advisors, Inc.	Bethesda
Blue Chip Venture Company	Annapolis
Boulder Ventures, Ltd	Owings Mills
Calvert Group, Ltd.	Bethesda
Camden Partners Holdings, LLC	Baltimore
Carmel Associates	Bethesda
Chesapeake Innovation Center	Annapolis
Clark Enterprises, Inc.	Bethesda
Cosmos Alliance	Bethesda
Emerging Technology Partners, LLC	Rockville
Grotech Capital Group	Timonium
Integral Capital Partners	Baltimore
JMI	Baltimore
Kinetic Ventures	Chevy Chase
Laminar Direct Capital LP (LDC)	Bethesda
Legend Ventures, LLC	Bethesda
Maryland Technology Development Corporation (TEDCO)	Columbia
MdBio, Inc.	Frederick
MedImmune Ventures, Inc.	Gaithersburg
Meridian Management Group, Inc. (MMG)	Baltimore
Montagu Newhall Associates	Owings Mills
NeoTech Incubator	Columbia
New Enterprise Associates (NEA)	Baltimore
New Enterprise Associates (NEA)	Chevy Chase
New Markets Growth Fund	College Park
Nobska Ventures	Stevenson
Novak Biddle Venture Partners (NBVP)	Bethesda
Ocean Tomo Capital Fund	Bethesda
OCG Ventures, LLC	Columbia
Pentaport Venture Advisors	Bethesda
QuestMark Partners	Baltimore
Red Abbey Venture Partners, LLC	Baltimore
Rhodes Partners	Bethesda

[47] Massinvestor Inc., provides a comprehensive listing on venture capital firms in its "Mid-Atlantic Venture Capital and Private Equity Directory," available for purchase from their Web site at http://www.massinvestor.com/midatlantic_vc.htm.

Firm	City
Spring Capital	Baltimore
Sterling Venture Partners	Baltimore
SYNCOM Management Company, Inc.	Stevenson
Toucan Capital Corporation	Bethesda
Venturepreneur Partners	Columbia
Walker Ventures	Glenwood

Table C-2. Maryland Investment Capital Firms Active in Quarter 2, 2007[48]

Firm	City
American Capital Strategies	Bethesda
Boulder Ventures, Ltd.	Owings Mills
Calvert Funds	Bethesda
Calvert Street Capital Partners, Inc. (FKA: Legg Mason)	Baltimore
Camden Partners, Inc. (FKA: Cahill, Warnock & Co. LLC)	Baltimore
CNF Investments, LLC	Bethesda
Grotech Capital Group	Timonium
Kinetic Ventures LLC	Chevy Chase
Maryland DBED (AKA: Dept. of Business & Economic Development)	Baltimore
Maryland Technology Development Corporation (TEDCO)	Columbia
Meridian Management Group, Inc. (AKA: MMG)	Baltimore
Montagu Newhall Associates	Owings Mills
New Enterprise Associates	Baltimore
New Markets Growth Fund	College Park
Novak Biddle Venture Partners, L.P.	Bethesda
QuestMark Partners, L.P.	Baltimore
Red Abbey Venture Partners, LLC	
Toucan Capital	Baltimore
Walker Ventures SBIC (AKA: Walker Ventures)	Glenwood

[48] From the PriceWaterhouseCoopers MoneyTree Report. Available online at https://www.pwcmoneytree.com/MTPublic/ns/nav.jsp?page=vcreg

Attachment D

Qualitative Survey Results

Qualitative Results from Incubator Client Survey

Survey Respondent Characteristics
Total Respondents: 161
Response Rate: 45%
Current Incubator Clients: 101 (63% of total respondents)
Incubator Graduates: 32 (20% of total respondents)
Not specified: 28 (17% of total respondents)

Table D-1. Overall Importance of Incubator Experience

Client Type	Mean Rating (0–4 scale, 4 is extremely important)
Current client	3.1
Graduate	3.2

Table D-2. Current Clients: Most Important Incubator Services

Service	Mean Rating of Companies Offered Service (0–4 scale)
Affordable, functional space	**3.6**
Shared office facilities	2.9
Access to mentors, services	2.7
Individual business counseling	2.6
Incubator company networking	2.6
Connections to funding sources	2.5
Training programs/workshops	2.1
Access to univ. IP/tech transfer	1.9
Legal clinic/assistance	1.8
Shared biotech equipment	1.7
Shared biotech equipment, biotech companies only	2.8

Table D-3. Graduates: Most Important Incubator Services

Service	Mean Rating of Companies Offered Service (0–4 scale)
Affordable, functional space	**3.5**
Shared office facilities	3.0
Access to mentors, services	2.7
Individual business counseling	2.5
Incubator company networking	2.5

Service	Mean Rating of Companies Offered Service (0–4 scale)
Connections to funding sources	2.2
Training programs/workshops	1.9
Access to univ. IP/tech transfer	1.7
Legal clinic/assistance	1.6
Shared biotech equipment	1.2
Shared biotech equipment, biotech companies only	1.7

Table D-4. Current Clients: Services/Facilities Not Provided by Incubator—Do You Wish It Had Been Provided?

Service/Facility	Yes	Don't Care	NA/It was Provided
Legal clinic/assistance	40	20	39
Connections with funding sources	39	10	50
Training programs/workshops	30	11	58
Individualized business counseling	33	12	54
Access to mentors and professional service providers	37	12	50
Networking among incubator companies	27	9	63
Shared office facilities	26	4	69
Shared biotech equipment	10	34	55
Shared biotech equipment, biotech companies only	7	1	11
Space that is functional, affordable, flexible terms	32	2	65
Access to university intellectual property/tech transfer office	33	14	52

Table D-5. Graduates: Services/Facilities Not Provided by Incubator—Do You Wish It Had Been Provided?

Service/Facility	Yes	Don't Care	NA/It was Provided
Legal clinic/assistance	9	10	13
Connections with funding sources	11	2	19
Training programs/workshops	9	4	19
Individualized business counseling	11	6	15
Access to mentors and professional service providers	14	3	15
Networking among incubator companies	10	4	18

Service/Facility	Yes	Don't Care	NA/It was Provided
Shared office facilities	10	4	18
Shared biotech equipment	3	10	19
Shared biotech equipment, biotech companies only	2	1	8
Space that is functional, affordable, flexible terms	14	1	17
Access to university intellectual property/tech transfer office	8	7	17

Table D-6. Current Clients: Most Important Post-Incubator Services and Facilities upon Graduation

Service/Facility	Mean Rating (0–4 scale)
Reduced-rent office space	3.0
Networking with other companies	2.7
Access to trained workforce	2.6
Assistance with raising equity capital	2.6
Business development assistance	2.4
Management skill development	2.4
General business mentoring	2.1
Customizable, affordable IT space	2.0
Customizable, affordable IT space, IT companies only	2.7
Loans for fitting out space	2.0
Wet lab facilities	0.8
Wet lab facilities, biotech companies only	3.1
Customizable, affordable biotech space	0.8
Customizable, affordable biotech space, biotech companies only	3.0

Table D-7. Graduates: Most Important Post-Incubator Services and Facilities

Service/Facility	Mean Rating (0–4 scale, 4 is extremely important)
Access to trained workforce	3.1
Reduced-rent office space	3.1
Networking with other companies	2.5
Loans for fitting out space	2.1
Management skill development	2.1

Service/Facility	Mean Rating (0–4 scale, 4 is extremely important)
Business development assistance	2.0
Customizable, affordable IT space	2.0
Customizable, affordable IT space, IT companies only	3.0
Assistance with raising equity capital	2.0
General business mentoring	1.9
Wet lab facilities	1.6
Wet lab facilities, biotech companies only	3.4
Customizable, affordable biotech space	1.4
Customizable, affordable biotech space, biotech companies only	3.7

Table D-8. Current Clients: Most Serious Barriers to Success upon Graduation

Barrier	Mean Rating (0–4 scale, 4 is extremely serious)
Lack of affordable space	2.2
Business climate/market	2.1
Lack of equity funding	2.0
Lack of trained workforce	1.9
Lack of appropriate space	1.7
Lack of public grant funds	1.6
Lack of business expertise	1.4
Access to clinical trials	0.5

Table D-9. Graduates: Most Serious Barriers to Success

Barrier	Mean Rating (0–4 scale, 4 is extremely serious)
Lack of public grant funds	1.5
Business climate/market	1.5
Lack of trained workforce	1.5
Lack of equity funding	1.4
Lack of business expertise	1.4
Lack of affordable space	1.3

Barrier	Mean Rating (0–4 scale, 4 is extremely serious)
Lack of appropriate space	1.1
Access to clinical trials	0.6

Table D-10. Current Clients: Effects of Incubator Tenancy

Service/Facility	Improved	Hampered	No Effect	NA
Has your incubator tenancy/affiliation affected your company's ability to raise capital?	47	0	29	23
Has your incubator tenancy/affiliation affected your company's ability to license technology from a university?	17	0	29	53

Table D-11. Graduates: Effects of Incubator Tenancy

Service/Facility	Improved	Hampered	No Effect	NA
Did your incubator tenancy/affiliation affect your company's ability to raise capital?	13	0	11	8
Did your incubator tenancy/affiliation affect your company's ability to license technology from a university?	4	0	12	16

Table D-12. Current Clients: Effects of Equity/Royalty Stakes

	Yes	No	
A. Does the incubator have an equity or royalty stake in your company?	26	73	
For those that answered "Yes" to part A:	**Improve**	**Hamper**	**No Effect**
B. Does this equity/royalty stake improve, hamper, or have no effect on your firm's ability to procure venture capital investment?	2	2	22
For those that answered "Yes" to part A:	**Incentive**	**Disincentive**	**No Impact**
C. Did the incubator's equity/royalty stake act as an incentive, disincentive, or have no impact on your firm's decision to locate in the incubator?	1	5	19

Table D-13. Graduates: Effects of Equity/Royalty Stakes

	Yes	No	
A. Did the incubator have an equity or royalty stake in your company?	8	24	
For those that answered "Yes" to part A:	**Improve**	**Hamper**	**No Effect**
B. Did this equity/royalty stake improve, hamper, or have no effect on your firm's ability to procure venture capital investment?	0	2	6
For those that answered "Yes" to part A:	**Incentive**	**Disincentive**	**No Impact**
C. Did the incubator's equity/royalty stake act as an incentive, disincentive, or have no impact on your firm's decision to locate in the incubator?	0	3	5

Table D-14. Graduates: Other Services and Resources–Have You Utilized These Resources?

	Yes	No
Maryland Department of Business & Economic Development (DBED)	22	8
Maryland Technology Enterprise Institute (MTECH)	2	28
Small Business Development Centers (SBDC)	3	27
Maryland Industrial Partnerships Program (MIPS)	10	20
Technology councils in the state	8	22
Manufacturing Extension Partnership (MEP)	0	30
Technology Transfer Office	4	26

Attachment E

List of Interviewees

Table E-1. Interviewees: Incubator Managers and Stakeholders

Interviewee Name		Organization
Henry	Bernstein	Scheer Partners
Danita	Boonchaisri	Calvert County
Robert	Brennan	Maryland Economic Development Corporation
Mike	Dailey	Fredrick Innovative Technology Center
Dan	Gincel	Maryland Technology Development Corporation
Rob	Griesdach	Beltsville Agricultural Research Center
Ellen	Hemmerly	techcenter@UMBC
Jim	Henry	Maryland Department of Business and Economic Development
Ron	Korcak	Beltsville Agricultural Research Center
John	Korpella	Montgomery County Department of Economic Development
Ann	Lansinger	Emerging Technology Center
Patricia	Larabee	Facility Logix
Roger	London	Chesapeake Innovation Center
P. Chris	Marschner	Hagerstown Community College Technical Innovation Center
Hans	Mayer	East Baltimore Development Inc.
Carol	Morrison	Neotech
Wanda	Plumer	Prince George's County Technology Assistance Center
Jane	Schaab	University of Maryland-Baltimore
Ruth	Semple	Montgomery County Department of Economic Development
Phil	Singerman	Toucan Capital

Table E-2. Focus Groups: Incubator Clients

Focus Group Companies
Acagi
Athena Environmental Sciences
Aurora Analytics
BioSciCon
Blue Wave Semiconductors
Chromotrax
Columbia Technologies
Cooper Photonics
Dragon Development
Ilex engineering Inc.
Integrated BioTherapeutics
Liquid Web Designs
Matrix Systems and Technologies
Maximum Quest Group
Newregen
Pique Performance
Profectus Biosciences
TMI Solutions
UnaTek

Attachment F

Interview Protocols

Interview and Focus Group Questions by Interviewee Type

Incubator Mangers:

- Can you describe Maryland's incubator program in general and what your incubator does specifically in this region?
- What is your specific role in the incubator?
- In your opinion, how does the incubator program fit into the larger Maryland economic development landscape?
- Given the services incubators are providing in the state, what parts of your incubator program do you think are making the most positive difference in the area's technology economy?
- Are there any services/facilities not currently offered that you think would be useful to provide to companies? Why?
- Graduation: What happens to companies when they graduate? In general do they have a place to go? If so, where?
- Are there any issues with affordable space for companies, particularly life sciences companies? Are there other services that could be provided for graduates such as:
  - 2nd level space like accelerators?
  - Subsidized rent in research parks,
  - link them up with universities, etc
  - tenant fit out fund
- Are there other problems that you see could be addressed through the incubator or post-incubator programs?
- We also wanted to ask you some questions about issues of incubators taking equity or royalty stakes in their tenant companies. Do you take equity/royalty stakes and if so, how do you structure them? Do you think different structures make a difference in how they affect the companies?
- Do you think funding payback requirements from TEDCO encourage incubators to require the equity/royalty stakes?
- Overall, do you think there is political support in MD for the existing incubators? For new incubators? Is more of a state-level effort or are there people in the local community driving the incubator/incubation?
- Do you think there is the potential for a niche incubator in MD concentrating on stem cell research or alternative energy and bio-fuels? Why or why not?

Incubator Clients:

- Tell us a little bit about your business and how you fit within the incubator. How do you think the incubator program fits into the MD small business and technology landscape?
- What parts of the incubator program do you think are making the most positive difference for your company?

- What services/facilities would you like to see provided by the incubator program to help your company succeed? What problems need to/could be addressed? Are there things incubators are negative for companies?

- We also wanted to ask you some questions about issues of incubators taking equity or royalty stakes in their tenant companies. Do you have an opinion about incubators taking equity/royalty stakes? Does it act as an incentive or disincentive to locating in an incubator? Does this cause a problem for getting venture capital investment further down the line? Does it affect your company in other ways? Do you have preferences for the way these deals are structured? Why?
- Graduation: What are likely places for your company to locate when you graduate? Are there any issues with affordable space for companies, particularly life sciences companies? Are there other services that could be provided for graduates like:
  - 2nd level space like accelerators?
  - Subsidized rent in research parks,
  - link them up with universities, etc
  - tenant fit out fund
- Are there other graduate problems that could be addressed through the incubator or post-incubator programs?

Economic Development Leaders and Other Stakeholders:

- Tell us about your role in/relationship to Maryland's incubator program.
- How do you think the incubator program fits into the MD economic development landscape?
- What parts of the incubator program do you think are making the most positive difference in MD's technology economy?
- What problems need to/could be addressed by additional incubator services and programs and how would incubators address them? Are there things incubators are doing that they shouldn't be?
- Graduation: What happens to companies when they graduate? In general do they have a place to go? If so, where?
- Are there any issues with affordable space for companies, particularly life sciences companies? Are there other services that could be provided for graduates like:
  - 2nd level space like accelerators?
  - Subsidized rent in research parks,
  - link them up with universities, etc
  - tenant fit out fund
- Are there other problems that you see could be addressed through the incubator or post-incubator programs?

- Overall, do you think there is political support in MD for the existing incubators? For new incubators? Is more of a state-level effort or are there people in the local community driving the incubator/incubation?
- Given the level of political support and other current economic, etc. conditions, do you think there is the potential for a niche incubator in MD concentrating on stem cell research or alternative energy and bio-fuels? Why or why not?
- What are the big picture effects of the incubator program on MD's economy? Does/how does it affect the entrepreneurial climate, community building, innovation, etc?

Attachment G

Econometric Analysis

If analysts cannot properly identify sources of expenditure changes or incorrectly measure the direct impact of the evaluated program, the IMPLAN model can substantially overstate the economic effects of a program. In light of these concerns, RTI used an exploratory econometric analysis to evaluate whether the predictions coming from the IMPLAN analysis (employment and personal income changes) substantially exceeded observed historical relationships between incubator establishment and economic activity. Although these tests do not provide definitive statements about the precision of the I/O models estimates, this assessment adds value to the analysis by providing some empirical basis for assessing whether model results are credible. This attachment describes the econometric analysis and estimates in more detail.

Econometric Model and Estimation Method

A basic linear regression model compares economic variables in counties with and without incubators as follows:

$$\log y_{it} = \text{intercept} + b*IB_{it} + u_{it}$$

where the variable y_{it} is the labor force and a personal income variable; IB is a binary variable that equals 1 if the county has an incubator program in year t, and 0 otherwise; and u_{it} is the error term. The coefficient on IB dummy (b) measures the percentage change in labor force or personal income due to the presence of the program; the hypothesis is that this value is positive and economically significant. However, the two sets of counties likely differ in a variety of other ways and excluding these variables can lead to biased estimates of the incubators effect (b). To address these concerns, RTI adopted a more flexible model.[49]

$$\log y_{it} = c_i + g_i t + b*IB_{it} + d_t + u_{it}$$

With this specification, we control for the following factors:

- differences in employment levels due to unique county characteristics (e.g., geography and public infrastructure) that show little variation over time (c_i);
- unique county employment or personal income growth rates (g_i); and
- aggregate time effects (d_t) common to all counties.

Boarnet (1991) notes the estimation of this model can be achieved by differencing the economic variable and incubator indicator variable (subtracting values from any year from the values of the next year); include dummy variables for each county (which controls for unique

[49] The literature frequently refers to this model as the random growth model (Heckman and Holz, 1989; Wooldridge, 2002 [p. 316]).

county characteristics); and include dummy variables for each year (which controls for aggregate time trends that are common to all counties). RTI implemented this model using STATA 9.2 software.

Data

RTI collected the following data to support the empirical analysis (see **Table G-1**):

- county-level employed persons for Maryland (1990–2005) from the Bureau of Labor Statistics Local Area Unemployment Statistics Program,
- county-level per-capita personal income for Maryland from the Bureau of Economic analysis (1980–2004), and
- timing of establishment of incubators from MIBA association surveys.[50]

Table G-1. Variable Descriptions

Variable	Descriptions of Variable
employed:	includes all persons classified by the BLS as employed
unemploymentrate:	represents the number unemployed as a percent of the labor force
r_pinc:	real per capita personal income (2005 dollars)
IB	=1 if a county has an incubator in year t, 0 otherwise

As shown in **Table G-2**, the average employment in a Maryland county during the period of analysis was 110,000 and ranged from 8,800 to 505,000 thousand people. Unemployment rates averaged 5.4 percent and ranges from 1.8 percent to 15 percent. Real per capita income averaged approximately $30,000 and range from $14,000 to $60,000.[51]

[50] Incubators included in this analysis are listed in **Table G-5** at the end of this attachment.

[51] RTI adjusted per capita income variables to reflect 2005 dollars using the consumer price index (CPI). The calculation is:

$$\text{Per capita income in 2005 dollars} = \text{Per capita income in year t} \times \frac{\text{CPI in 2005}}{\text{CPI in year t}}$$

. CPI data for the analysis are reported in **Table G-6** at then end of this attachment.

Table G-2. Summary Statistics for Variables

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
employed:	408	110,348	136,330	8,819	504,751
unemploymentrate:	408	5.4%	2.5%	1.8%	15.0%
r_pinc:	600	$29,684	$7,672	$14,275	$58,582

Results

As shown in **Table G-3**, the empirical analysis an upper bound estimate of net increases in county-level labor force is 0.8 percent. The upper bound estimate for real per capita personal income changes was computed to be 1.3 percent (see **Table G-4**).

Table G-3. Employment Model Results

Variable	Results
IB	**Coefficient[a]:** –0.002
	Robust Standard Error: (0.0051)
	95% Confidence Interval = 0.8 percent
Other Model Characteristics and Results	
Year dummies	Yes
County dummies	Yes
Observations:	384
R-Square	0.20

[a] The coefficient in this regression is not measured precisely and is not statistically significant from zero.

Table G-4. Real Per Capita Personal Income Model Results

Variable	Results
IB	**Coefficient[a]:** 0.0047
	Robust Standard Error: (0.004)
	95% Confidence Interval = 1.3 percent
Other Model Characteristics and Results	
Year dummies	Yes
County dummies	Yes
Observations:	576
R-Square	0.57

[a] The coefficient in this regression is not measured precisely and is not statistically significant from zero.

Table G-5. Incubators Included in the Econometric Analysis

Incubator	County	Established Year
Technical Innovation Center At Hagerstown Community College	Washington	1994
NeoTech Incubator	Howard	2000
Silver Springs Innovation Center	Montgomery	2005
Maryland Technology Development Center	Montgomery	1999
Technology Advancement Program at University of Maryland	Prince George's	1984
Emerging Technology Center and ETC@John Hopkins Eastern	Baltimore City	1999
Higher Education and Applied Technology (HEAT) Center	Harford	1999
Prince George's County Technology Assistance Center	Prince George's	2001
techcenter@UMBC	Baltimore	1989
Chesapeake Innovation Center	Anne Arundel	2003
Frederick Innovative Technology Center	Frederick	2005
Garrett Information Enterprise Center	Garrett	2002
Wheaton Innovation Center	Montgomery	2006
Calvert County Business Incubator	Calvert	2001
Charles County Business Incubator	Charles	2001

Table G-6. Consumer Price Index Values

Year	Value	Adjustment Factor
1980	82.4	2.37
1981	90.9	2.15
1982	96.5	2.02
1983	99.6	1.96
1984	103.9	1.88
1985	107.6	1.82
1986	109.6	1.78
1987	113.6	1.72
1988	118.3	1.65
1989	124.0	1.58
1990	130.7	1.49
1991	136.2	1.43
1992	140.3	1.39
1993	144.5	1.35
1994	148.2	1.32
1995	152.4	1.28
1996	156.9	1.24
1997	160.5	1.22
1998	163.0	1.20
1999	166.6	1.17
2000	172.2	1.13
2001	177.1	1.10
2002	179.9	1.09
2003	184.0	1.06
2004	188.9	1.03
2005	195.3	1.00
2006	201.6	0.97

Source: U.S. Bureau of Labor Statistics. Consumer Price Index, U.S. City Average, All Items. Series ID: CUUR0000SA0. As obtained April 10, 2007.

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Attachment H

IMPLAN Industries

Industry/Commodity Codes in the IMPLAN Model

The following table provides the IMPLAN Industry/Commodity Codes and show the industry mapping used for the report presentation in Section 2.

Table H-1. Industry/Commodity Codes in the IMPLAN Model

IMPLAN Industry	Description	Industry for Report
1	Oilseed farming	Agriculture
2	Grain farming	Agriculture
3	Vegetable and melon farming	Agriculture
4	Tree nut farming	Agriculture
5	Fruit farming	Agriculture
6	Greenhouse and nursery production	Agriculture
7	Tobacco farming	Agriculture
8	Cotton farming	Agriculture
9	Sugarcane and sugar beet farming	Agriculture
10	All other crop farming	Agriculture
11	Cattle ranching and farming	Agriculture
12	Poultry and egg production	Agriculture
13	Animal production- except cattle and poultry	Agriculture
14	Logging	Agriculture
15	Forest nurseries- forest products- and timber	Agriculture
16	Fishing	Agriculture
17	Hunting and trapping	Agriculture
18	Agriculture and forestry support activities	Agriculture
19	Oil and gas extraction	Mining
20	Coal mining	Mining
21	Iron ore mining	Mining
22	Copper- nickel- lead- and zinc mining	Mining
23	Gold- silver- and other metal ore mining	Mining
24	Stone mining and quarrying	Mining
25	Sand- gravel- clay- and refractory mining	Mining
26	Other non-metallic mineral mining	Mining
27	Drilling oil and gas wells	Mining
28	Support activities for oil and gas operations	Mining
29	Support activities for other mining	Mining
30	Power generation and supply	Utilities
31	Natural gas distribution	Utilities
32	Water- sewage and other systems	Utilities
33	New residential 1-unit structures- all	Construction
34	New multifamily housing structures- all	Construction
35	New residential additions and alterations-all	Construction
36	New farm housing units	Construction
37	Manufacturing and industrial buildings	Construction
38	Commercial and institutional buildings	Construction
39	Highway- street- bridge- and tunnel construct	Construction
40	Water- sewer- and pipeline construction	Construction
41	Other new construction	Construction

IMPLAN Industry	Description	Industry for Report
42	Maintenance and repair of farm and non-farm residential structures	Construction
43	Maintenance and repair of non-residential buildings	Construction
44	Maintenance and repair of highways, streets, bridges, and tunnels	Construction
45	Other maintenance and repair construction	Construction
46	Dog and cat food manufacturing	Nondurable Goods Manufacturing
47	Other animal food manufacturing	Nondurable Goods Manufacturing
48	Flour milling	Nondurable Goods Manufacturing
49	Rice milling	Nondurable Goods Manufacturing
50	Malt manufacturing	Nondurable Goods Manufacturing
51	Wet corn milling	Nondurable Goods Manufacturing
52	Soybean processing	Nondurable Goods Manufacturing
53	Other oilseed processing	Nondurable Goods Manufacturing
54	Fats and oils refining and blending	Nondurable Goods Manufacturing
55	Breakfast cereal manufacturing	Nondurable Goods Manufacturing
56	Sugar manufacturing	Nondurable Goods Manufacturing
57	Confectionery manufacturing from cacao beans	Nondurable Goods Manufacturing
58	Confectionery manufacturing from purchased chocolate	Nondurable Goods Manufacturing
59	Nonchocolate confectionery manufacturing	Nondurable Goods Manufacturing
60	Frozen food manufacturing	Nondurable Goods Manufacturing
61	Fruit and vegetable canning and drying	Nondurable Goods Manufacturing
62	Fluid milk manufacturing	Nondurable Goods Manufacturing
63	Creamery butter manufacturing	Nondurable Goods Manufacturing
64	Cheese manufacturing	Nondurable Goods Manufacturing
65	Dry- condensed- and evaporated dairy products	Nondurable Goods Manufacturing
66	Ice cream and frozen dessert manufacturing	Nondurable Goods Manufacturing
67	Animal- except poultry- slaughtering	Nondurable Goods Manufacturing
68	Meat processed from carcasses	Nondurable Goods Manufacturing
69	Rendering and meat byproduct processing	Nondurable Goods Manufacturing
70	Poultry processing	Nondurable Goods Manufacturing
71	Seafood product preparation and packaging	Nondurable Goods Manufacturing
72	Frozen cakes and other pastries manufacturing	Nondurable Goods Manufacturing
73	Bread and bakery product, except frozen, manufacturing	Nondurable Goods Manufacturing
74	Cookie and cracker manufacturing	Nondurable Goods Manufacturing
75	Mixes and dough made from purchased flour	Nondurable Goods Manufacturing
76	Dry pasta manufacturing	Nondurable Goods Manufacturing
77	Tortilla manufacturing	Nondurable Goods Manufacturing
78	Roasted nuts and peanut butter manufacturing	Nondurable Goods Manufacturing
79	Other snack food manufacturing	Nondurable Goods Manufacturing
80	Coffee and tea manufacturing	Nondurable Goods Manufacturing
81	Flavoring syrup and concentrate manufacturing	Nondurable Goods Manufacturing
82	Mayonnaise- dressing- and sauce manufacturing	Nondurable Goods Manufacturing
83	Spice and extract manufacturing	Nondurable Goods Manufacturing
84	All other food manufacturing	Nondurable Goods Manufacturing
85	Soft drink and ice manufacturing	Nondurable Goods Manufacturing

IMPLAN Industry	Description	Industry for Report
86	Breweries	Nondurable Goods Manufacturing
87	Wineries	Nondurable Goods Manufacturing
88	Distilleries	Nondurable Goods Manufacturing
89	Tobacco stemming and redrying	Nondurable Goods Manufacturing
90	Cigarette manufacturing	Nondurable Goods Manufacturing
91	Other tobacco product manufacturing	Nondurable Goods Manufacturing
92	Fiber- yarn- and thread mills	Nondurable Goods Manufacturing
93	Broadwoven fabric mills	Nondurable Goods Manufacturing
94	Narrow fabric mills and Schiffli embroidery	Nondurable Goods Manufacturing
95	Nonwoven fabric mills	Nondurable Goods Manufacturing
96	Knit fabric mills	Nondurable Goods Manufacturing
97	Textile and fabric finishing mills	Nondurable Goods Manufacturing
98	Fabric coating mills	Nondurable Goods Manufacturing
99	Carpet and rug mills	Nondurable Goods Manufacturing
100	Curtain and linen mills	Nondurable Goods Manufacturing
101	Textile bag and canvas mills	Nondurable Goods Manufacturing
102	Tire cord and tire fabric mills	Nondurable Goods Manufacturing
103	Other miscellaneous textile product mills	Nondurable Goods Manufacturing
104	Sheer hosiery mills	Nondurable Goods Manufacturing
105	Other hosiery and sock mills	Nondurable Goods Manufacturing
106	Other apparel knitting mills	Nondurable Goods Manufacturing
107	Cut and sew apparel manufacturing	Nondurable Goods Manufacturing
108	Accessories and other apparel manufacturing	Nondurable Goods Manufacturing
109	Leather and hide tanning and finishing	Nondurable Goods Manufacturing
110	Footwear manufacturing	Nondurable Goods Manufacturing
111	Other leather product manufacturing	Nondurable Goods Manufacturing
112	Sawmills	Durable Goods Manufacturing
113	Wood preservation	Durable Goods Manufacturing
114	Reconstituted wood product manufacturing	Durable Goods Manufacturing
115	Veneer and plywood manufacturing	Durable Goods Manufacturing
116	Engineered wood member and truss manufacturing	Durable Goods Manufacturing
117	Wood windows and door manufacturing	Durable Goods Manufacturing
118	Cut stock- resawing lumber- and planing	Durable Goods Manufacturing
119	Other millwork- including flooring	Durable Goods Manufacturing
120	Wood container and pallet manufacturing	Durable Goods Manufacturing
121	Manufactured home- mobile home- manufacturing	Durable Goods Manufacturing
122	Prefabricated wood building manufacturing	Durable Goods Manufacturing
123	Miscellaneous wood product manufacturing	Durable Goods Manufacturing
124	Pulp mills	Nondurable Goods Manufacturing
125	Paper and paperboard mills	Nondurable Goods Manufacturing
126	Paperboard container manufacturing	Nondurable Goods Manufacturing
127	Flexible packaging foil manufacturing	Nondurable Goods Manufacturing
128	Surface-coated paperboard manufacturing	Nondurable Goods Manufacturing
129	Coated and laminated paper and packaging mate	Nondurable Goods Manufacturing
130	Coated and uncoated paper bag manufacturing	Nondurable Goods Manufacturing
131	Die-cut paper office supplies manufacturing	Nondurable Goods Manufacturing
132	Envelope manufacturing	Nondurable Goods Manufacturing

IMPLAN Industry	Description	Industry for Report
133	Stationery and related product manufacturing	Nondurable Goods Manufacturing
134	Sanitary paper product manufacturing	Nondurable Goods Manufacturing
135	All other converted paper product manufacturing	Nondurable Goods Manufacturing
136	Manifold business forms printing	Nondurable Goods Manufacturing
137	Books printing	Nondurable Goods Manufacturing
138	Blankbook and looseleaf binder manufacturing	Nondurable Goods Manufacturing
139	Commercial printing	Nondurable Goods Manufacturing
140	Tradebinding and related work	Nondurable Goods Manufacturing
141	Prepress services	Nondurable Goods Manufacturing
142	Petroleum refineries	Nondurable Goods Manufacturing
143	Asphalt paving mixture and block manufacturing	Nondurable Goods Manufacturing
144	Asphalt shingle and coating materials manufacturing	Nondurable Goods Manufacturing
145	Petroleum lubricating oil and grease manufacturing	Nondurable Goods Manufacturing
146	All other petroleum and coal products manufacturing	Nondurable Goods Manufacturing
147	Petrochemical manufacturing	Nondurable Goods Manufacturing
148	Industrial gas manufacturing	Nondurable Goods Manufacturing
149	Synthetic dye and pigment manufacturing	Nondurable Goods Manufacturing
150	Other basic inorganic chemical manufacturing	Nondurable Goods Manufacturing
151	Other basic organic chemical manufacturing	Nondurable Goods Manufacturing
152	Plastics material and resin manufacturing	Nondurable Goods Manufacturing
153	Synthetic rubber manufacturing	Nondurable Goods Manufacturing
154	Cellulosic organic fiber manufacturing	Nondurable Goods Manufacturing
155	Noncellulosic organic fiber manufacturing	Nondurable Goods Manufacturing
156	Nitrogenous fertilizer manufacturing	Nondurable Goods Manufacturing
157	Phosphatic fertilizer manufacturing	Nondurable Goods Manufacturing
158	Fertilizer- mixing only- manufacturing	Nondurable Goods Manufacturing
159	Pesticide and other agricultural chemical man	Nondurable Goods Manufacturing
160	Pharmaceutical and medicine manufacturing	Nondurable Goods Manufacturing
161	Paint and coating manufacturing	Nondurable Goods Manufacturing
162	Adhesive manufacturing	Nondurable Goods Manufacturing
163	Soap and other detergent manufacturing	Nondurable Goods Manufacturing
164	Polish and other sanitation good manufacturing	Nondurable Goods Manufacturing
165	Surface active agent manufacturing	Nondurable Goods Manufacturing
166	Toilet preparation manufacturing	Nondurable Goods Manufacturing
167	Printing ink manufacturing	Nondurable Goods Manufacturing
168	Explosives manufacturing	Nondurable Goods Manufacturing
169	Custom compounding of purchased resins	Nondurable Goods Manufacturing
170	Photographic film and chemical manufacturing	Nondurable Goods Manufacturing
171	Other miscellaneous chemical product manufacturing	Nondurable Goods Manufacturing
172	Plastics packaging materials- film and sheet	Nondurable Goods Manufacturing
173	Plastics pipe- fittings- and profile shapes	Nondurable Goods Manufacturing
174	Laminated plastics plate- sheet- and shapes	Nondurable Goods Manufacturing
175	Plastics bottle manufacturing	Nondurable Goods Manufacturing
176	Resilient floor covering manufacturing	Nondurable Goods Manufacturing

IMPLAN Industry	Description	Industry for Report
177	Plastics plumbing fixtures and all other plastics products	Nondurable Goods Manufacturing
178	Foam product manufacturing	Nondurable Goods Manufacturing
179	Tire manufacturing	Nondurable Goods Manufacturing
180	Rubber and plastics hose and belting manufacturing	Nondurable Goods Manufacturing
181	Other rubber product manufacturing	Nondurable Goods Manufacturing
182	Vitreous china plumbing fixture manufacturing	Durable Goods Manufacturing
183	Vitreous china and earthenware articles manufacturing	Durable Goods Manufacturing
184	Porcelain electrical supply manufacturing	Durable Goods Manufacturing
185	Brick and structural clay tile manufacturing	Durable Goods Manufacturing
186	Ceramic wall and floor tile manufacturing	Durable Goods Manufacturing
187	Non-clay refractory manufacturing	Durable Goods Manufacturing
188	Clay refractory and other structural clay pro	Durable Goods Manufacturing
189	Glass container manufacturing	Durable Goods Manufacturing
190	Glass and glass products, except glass containers	Durable Goods Manufacturing
191	Cement manufacturing	Durable Goods Manufacturing
192	Ready-mix concrete manufacturing	Durable Goods Manufacturing
193	Concrete block and brick manufacturing	Durable Goods Manufacturing
194	Concrete pipe manufacturing	Durable Goods Manufacturing
195	Other concrete product manufacturing	Durable Goods Manufacturing
196	Lime manufacturing	Durable Goods Manufacturing
197	Gypsum product manufacturing	Durable Goods Manufacturing
198	Abrasive product manufacturing	Durable Goods Manufacturing
199	Cut stone and stone product manufacturing	Durable Goods Manufacturing
200	Ground or treated minerals and earths manufacturing	Durable Goods Manufacturing
201	Mineral wool manufacturing	Durable Goods Manufacturing
202	Miscellaneous non-metallic mineral products	Durable Goods Manufacturing
203	Iron and steel mills	Durable Goods Manufacturing
204	Ferroalloy and related product manufacturing	Durable Goods Manufacturing
205	Iron, steel pipe and tube from purchased steel	Durable Goods Manufacturing
206	Rolled steel shape manufacturing	Durable Goods Manufacturing
207	Steel wire drawing	Durable Goods Manufacturing
208	Alumina refining	Durable Goods Manufacturing
209	Primary aluminum production	Durable Goods Manufacturing
210	Secondary smelting and alloying of aluminum	Durable Goods Manufacturing
211	Aluminum sheet- plate- and foil manufacturing	Durable Goods Manufacturing
212	Aluminum extruded product manufacturing	Durable Goods Manufacturing
213	Other aluminum rolling and drawing	Durable Goods Manufacturing
214	Primary smelting and refining of copper	Durable Goods Manufacturing
215	Primary non-ferrous metal, except copper and aluminum	Durable Goods Manufacturing
216	Copper rolling- drawing- and extruding	Durable Goods Manufacturing
217	Copper wire- except mechanical- drawing	Durable Goods Manufacturing
218	Secondary processing of copper	Durable Goods Manufacturing
219	Nonferrous metal, except copper and aluminum, shaping	Durable Goods Manufacturing
220	Secondary processing of other non-ferrous	Durable Goods Manufacturing

IMPLAN Industry	Description	Industry for Report
221	Ferrous metal foundries	Durable Goods Manufacturing
222	Aluminum foundries	Durable Goods Manufacturing
223	Nonferrous foundries- except aluminum	Durable Goods Manufacturing
224	Iron and steel forging	Durable Goods Manufacturing
225	Nonferrous forging	Durable Goods Manufacturing
226	Custom roll forming	Durable Goods Manufacturing
227	All other forging and stamping	Durable Goods Manufacturing
228	Cutlery and flatware- except precious- manufacturing	Durable Goods Manufacturing
229	Hand and edge tool manufacturing	Durable Goods Manufacturing
230	Saw blade and handsaw manufacturing	Durable Goods Manufacturing
231	Kitchen utensil- pot- and pan manufacturing	Durable Goods Manufacturing
232	Prefabricated metal buildings and components	Durable Goods Manufacturing
233	Fabricated structural metal manufacturing	Durable Goods Manufacturing
234	Plate work manufacturing	Durable Goods Manufacturing
235	Metal window and door manufacturing	Durable Goods Manufacturing
236	Sheet metal work manufacturing	Durable Goods Manufacturing
237	Ornamental and architectural metal work manufacturing	Durable Goods Manufacturing
238	Power boiler and heat exchanger manufacturing	Durable Goods Manufacturing
239	Metal tank- heavy gauge- manufacturing	Durable Goods Manufacturing
240	Metal can- box- and other container manufacturing	Durable Goods Manufacturing
241	Hardware manufacturing	Durable Goods Manufacturing
242	Spring and wire product manufacturing	Durable Goods Manufacturing
243	Machine shops	Durable Goods Manufacturing
244	Turned product and screw- nut- and bolt manufacturing	Durable Goods Manufacturing
245	Metal heat treating	Durable Goods Manufacturing
246	Metal coating and non-precious engraving	Durable Goods Manufacturing
247	Electroplating- anodizing- and coloring metal	Durable Goods Manufacturing
248	Metal valve manufacturing	Durable Goods Manufacturing
249	Ball and roller bearing manufacturing	Durable Goods Manufacturing
250	Small arms manufacturing	Durable Goods Manufacturing
251	Other ordnance and accessories manufacturing	Durable Goods Manufacturing
252	Fabricated pipe and pipe fitting manufacturing	Durable Goods Manufacturing
253	Industrial pattern manufacturing	Durable Goods Manufacturing
254	Enameled iron and metal sanitary ware manufacturing	Durable Goods Manufacturing
255	Miscellaneous fabricated metal product manufacturing	Durable Goods Manufacturing
256	Ammunition manufacturing	Durable Goods Manufacturing
257	Farm machinery and equipment manufacturing	Durable Goods Manufacturing
258	Lawn and garden equipment manufacturing	Durable Goods Manufacturing
259	Construction machinery manufacturing	Durable Goods Manufacturing
260	Mining machinery and equipment manufacturing	Durable Goods Manufacturing
261	Oil and gas field machinery and equipment	Durable Goods Manufacturing
262	Sawmill and woodworking machinery	Durable Goods Manufacturing
263	Plastics and rubber industry machinery	Durable Goods Manufacturing
264	Paper industry machinery manufacturing	Durable Goods Manufacturing

IMPLAN Industry	Description	Industry for Report
265	Textile machinery manufacturing	Durable Goods Manufacturing
266	Printing machinery and equipment manufacturing	Durable Goods Manufacturing
267	Food product machinery manufacturing	Durable Goods Manufacturing
268	Semiconductor machinery manufacturing	Durable Goods Manufacturing
269	All other industrial machinery manufacturing	Durable Goods Manufacturing
270	Office machinery manufacturing	Durable Goods Manufacturing
271	Optical instrument and lens manufacturing	Durable Goods Manufacturing
272	Photographic and photocopying equipment manufacturing	Durable Goods Manufacturing
273	Other commercial and service industry machine	Durable Goods Manufacturing
274	Automatic vending, commercial laundry and drycleaning machinery	Durable Goods Manufacturing
275	Air purification equipment manufacturing	Durable Goods Manufacturing
276	Industrial and commercial fan and blower manufacturing	Durable Goods Manufacturing
277	Heating equipment- except warm air furnaces	Durable Goods Manufacturing
278	AC- refrigeration- and forced air heating	Durable Goods Manufacturing
279	Industrial mold manufacturing	Durable Goods Manufacturing
280	Metal cutting machine tool manufacturing	Durable Goods Manufacturing
281	Metal forming machine tool manufacturing	Durable Goods Manufacturing
282	Special tool- die- jig- and fixture manufacturing	Durable Goods Manufacturing
283	Cutting tool and machine tool accessory manufacturing	Durable Goods Manufacturing
284	Rolling mill and other metalworking machinery	Durable Goods Manufacturing
285	Turbine and turbine generator set units manufacturing	Durable Goods Manufacturing
286	Other engine equipment manufacturing	Durable Goods Manufacturing
287	Speed changers and mechanical power transmission equipment	Durable Goods Manufacturing
288	Pump and pumping equipment manufacturing	Durable Goods Manufacturing
289	Air and gas compressor manufacturing	Durable Goods Manufacturing
290	Measuring and dispensing pump manufacturing	Durable Goods Manufacturing
291	Elevator and moving stairway manufacturing	Durable Goods Manufacturing
292	Conveyor and conveying equipment manufacturing	Durable Goods Manufacturing
293	Overhead cranes- hoists- and monorail systems	Durable Goods Manufacturing
294	Industrial truck- trailer- and stacker manufacturing	Durable Goods Manufacturing
295	Power-driven handtool manufacturing	Durable Goods Manufacturing
296	Welding and soldering equipment manufacturing	Durable Goods Manufacturing
297	Packaging machinery manufacturing	Durable Goods Manufacturing
298	Industrial process furnace and oven manufacturing	Durable Goods Manufacturing
299	Fluid power cylinder and actuator manufacturing	Durable Goods Manufacturing
300	Fluid power pump and motor manufacturing	Durable Goods Manufacturing
301	Scales, balances, and miscellaneous general purpose machinery	Durable Goods Manufacturing
302	Electronic computer manufacturing	Durable Goods Manufacturing
303	Computer storage device manufacturing	Durable Goods Manufacturing
304	Computer terminal manufacturing	Durable Goods Manufacturing

IMPLAN Industry	Description	Industry for Report
305	Other computer peripheral equipment manufacturing	Durable Goods Manufacturing
306	Telephone apparatus manufacturing	Durable Goods Manufacturing
307	Broadcast and wireless communications equipment	Durable Goods Manufacturing
308	Other communications equipment manufacturing	Durable Goods Manufacturing
309	Audio and video equipment manufacturing	Durable Goods Manufacturing
310	Electron tube manufacturing	Durable Goods Manufacturing
311	Semiconductors and related device manufacturing	Durable Goods Manufacturing
312	All other electronic component manufacturing	Durable Goods Manufacturing
313	Electromedical apparatus manufacturing	Durable Goods Manufacturing
314	Search- detection- and navigation instruments	Durable Goods Manufacturing
315	Automatic environmental control manufacturing	Durable Goods Manufacturing
316	Industrial process variable instruments	Durable Goods Manufacturing
317	Totalizing fluid meters and counting devices	Durable Goods Manufacturing
318	Electricity and signal testing instruments	Durable Goods Manufacturing
319	Analytical laboratory instrument manufacturing	Durable Goods Manufacturing
320	Irradiation apparatus manufacturing	Durable Goods Manufacturing
321	Watch- clock- and other measuring and control	Durable Goods Manufacturing
322	Software reproducing	Durable Goods Manufacturing
323	Audio and video media reproduction	Durable Goods Manufacturing
324	Magnetic and optical recording media manufacturing	Durable Goods Manufacturing
325	Electric lamp bulb and part manufacturing	Durable Goods Manufacturing
326	Lighting fixture manufacturing	Durable Goods Manufacturing
327	Electric housewares and household fan manufacturing	Durable Goods Manufacturing
328	Household vacuum cleaner manufacturing	Durable Goods Manufacturing
329	Household cooking appliance manufacturing	Durable Goods Manufacturing
330	Household refrigerator and home freezer manufacturing	Durable Goods Manufacturing
331	Household laundry equipment manufacturing	Durable Goods Manufacturing
332	Other major household appliance manufacturing	Durable Goods Manufacturing
333	Electric power and specialty transformer manufacturing	Durable Goods Manufacturing
334	Motor and generator manufacturing	Durable Goods Manufacturing
335	Switchgear and switchboard apparatus manufacturing	Durable Goods Manufacturing
336	Relay and industrial control manufacturing	Durable Goods Manufacturing
337	Storage battery manufacturing	Durable Goods Manufacturing
338	Primary battery manufacturing	Durable Goods Manufacturing
339	Fiber optic cable manufacturing	Durable Goods Manufacturing
340	Other communication and energy wire manufacturing	Durable Goods Manufacturing
341	Wiring device manufacturing	Durable Goods Manufacturing
342	Carbon and graphite product manufacturing	Durable Goods Manufacturing
343	Miscellaneous electrical equipment manufacturing	Durable Goods Manufacturing
344	Automobile and light truck manufacturing	Durable Goods Manufacturing
345	Heavy duty truck manufacturing	Durable Goods Manufacturing

IMPLAN Industry	Description	Industry for Report
346	Motor vehicle body manufacturing	Durable Goods Manufacturing
347	Truck trailer manufacturing	Durable Goods Manufacturing
348	Motor home manufacturing	Durable Goods Manufacturing
349	Travel trailer and camper manufacturing	Durable Goods Manufacturing
350	Motor vehicle parts manufacturing	Durable Goods Manufacturing
351	Aircraft manufacturing	Durable Goods Manufacturing
352	Aircraft engine and engine parts manufacturing	Durable Goods Manufacturing
353	Other aircraft parts and equipment	Durable Goods Manufacturing
354	Guided missile and space vehicle manufacturing	Durable Goods Manufacturing
355	Propulsion units and parts for space vehicles	Durable Goods Manufacturing
356	Railroad rolling stock manufacturing	Durable Goods Manufacturing
357	Ship building and repairing	Durable Goods Manufacturing
358	Boat building	Durable Goods Manufacturing
359	Motorcycle- bicycle- and parts manufacturing	Durable Goods Manufacturing
360	Military armored vehicles and tank parts manufacturing	Durable Goods Manufacturing
361	All other transportation equipment manufacturing	Durable Goods Manufacturing
362	Wood kitchen cabinet and countertop manufacturing	Durable Goods Manufacturing
363	Upholstered household furniture manufacturing	Durable Goods Manufacturing
364	Non-upholstered wood household furniture manufacturing	Durable Goods Manufacturing
365	Metal household furniture manufacturing	Durable Goods Manufacturing
366	Institutional furniture manufacturing	Durable Goods Manufacturing
367	Other household and institutional furniture	Durable Goods Manufacturing
368	Wood office furniture manufacturing	Durable Goods Manufacturing
369	Custom architectural woodwork and millwork	Durable Goods Manufacturing
370	Office furniture- except wood- manufacturing	Durable Goods Manufacturing
371	Showcases- partitions- shelving- and lockers	Durable Goods Manufacturing
372	Mattress manufacturing	Durable Goods Manufacturing
373	Blind and shade manufacturing	Durable Goods Manufacturing
374	Laboratory apparatus and furniture manufacturing	Durable Goods Manufacturing
375	Surgical and medical instrument manufacturing	Durable Goods Manufacturing
376	Surgical appliance and supplies manufacturing	Durable Goods Manufacturing
377	Dental equipment and supplies manufacturing	Durable Goods Manufacturing
378	Ophthalmic goods manufacturing	Durable Goods Manufacturing
379	Dental laboratories	Durable Goods Manufacturing
380	Jewelry and silverware manufacturing	Durable Goods Manufacturing
381	Sporting and athletic goods manufacturing	Durable Goods Manufacturing
382	Doll- toy- and game manufacturing	Durable Goods Manufacturing
383	Office supplies- except paper- manufacturing	Durable Goods Manufacturing
384	Sign manufacturing	Durable Goods Manufacturing
385	Gasket- packing- and sealing device manufacturing	Durable Goods Manufacturing
386	Musical instrument manufacturing	Durable Goods Manufacturing
387	Broom- brush- and mop manufacturing	Durable Goods Manufacturing
388	Burial casket manufacturing	Durable Goods Manufacturing
389	Buttons- pins- and all other miscellaneous manufacturing	Durable Goods Manufacturing

IMPLAN Industry	Description	Industry for Report
390	Wholesale trade	Wholesale Trade
391	Air transportation	Transportation
392	Rail transportation	Transportation
393	Water transportation	Transportation
394	Truck transportation	Transportation
395	Transit and ground passenger transportation	Transportation
396	Pipeline transportation	Utilities
397	Scenic and sightseeing transportation and support activities for transportation	Transportation
398	Postal service	Other Services
399	Couriers and messengers	Transportation
400	Warehousing and storage	Warehousing
401	Motor vehicle and parts dealers	Retail Trade
402	Furniture and home furnishings stores	Retail Trade
403	Electronics and appliance stores	Retail Trade
404	Building material and garden supply stores	Retail Trade
405	Food and beverage stores	Retail Trade
406	Health and personal care stores	Retail Trade
407	Gasoline stations	Retail Trade
408	Clothing and clothing accessories stores	Retail Trade
409	Sporting goods- hobby- book and music stores	Retail Trade
410	General merchandise stores	Retail Trade
411	Miscellaneous store retailers	Retail Trade
412	Nonstore retailers	Retail Trade
413	Newspaper publishers	Information
414	Periodical publishers	Information
415	Book publishers	Information
416	Database- directory- and other publishers	Information
417	Software publishers	Information
418	Motion picture and video industries	Professional Services
419	Sound recording industries	Professional Services
420	Radio and television broadcasting	Professional Services
421	Cable networks and program distribution	Professional Services
422	Telecommunications	Professional Services
423	Information services	Professional Services
424	Data processing services	Professional Services
425	Non-depository credit intermediation and related activities	Finance Insurance & Real Estate
426	Securities- commodity contracts- investments	Finance Insurance & Real Estate
427	Insurance carriers	Finance Insurance & Real Estate
428	Insurance agencies- brokerages- and related	Finance Insurance & Real Estate
429	Funds- trusts- and other financial vehicles	Finance Insurance & Real Estate
430	Monetary authorities and depository credit intermediation	Finance Insurance & Real Estate
431	Real estate	Professional Services
432	Automotive equipment rental and leasing	Professional Services
433	Video tape and disc rental	Professional Services
434	Machinery and equipment rental and leasing	Professional Services

IMPLAN Industry	Description	Industry for Report
435	General and consumer goods rental except video tapes and discs	Professional Services
436	Lessors of non-financial intangible assets	Professional Services
437	Legal services	Professional Services
438	Accounting and bookkeeping services	Professional Services
439	Architectural and engineering services	Professional Services
440	Specialized design services	Professional Services
441	Custom computer programming services	Professional Services
442	Computer systems design services	Professional Services
443	Other computer related services, including facilities management	Professional Services
444	Management consulting services	Professional Services
445	Environmental and other technical consulting	Professional Services
446	Scientific research and development services	Professional Services
447	Advertising and related services	Professional Services
448	Photographic services	Professional Services
449	Veterinary services	Professional Services
450	All other miscellaneous professional and tech	Professional Services
451	Management of companies and enterprises	Professional Services
452	Office administrative services	Professional Services
453	Facilities support services	Professional Services
454	Employment services	Professional Services
455	Business support services	Professional Services
456	Travel arrangement and reservation services	Professional Services
457	Investigation and security services	Professional Services
458	Services to buildings and dwellings	Professional Services
459	Other support services	Professional Services
460	Waste management and remediation services	Professional Services
461	Elementary and secondary schools	Education
462	Colleges- universities- and junior colleges	Education
463	Other educational services	Education
464	Home health care services	Health
465	Offices of physicians, dentists, and other health practitioners	Health
466	Other ambulatory health care services	Health
467	Hospitals	Health
468	Nursing and residential care facilities	Health
469	Child day care services	Other Services
470	Social assistance, except child day care services	Other Services
471	Performing arts companies	Other Services
472	Spectator sports	Other Services
473	Independent artists- writers- and performers	Other Services
474	Promoters of performing arts and sports and agents for public figures	Other Services
475	Museums- historical sites- zoos- and parks	Other Services
476	Fitness and recreational sports centers	Other Services
477	Bowling centers	Other Services
478	Other amusement, gambling, and recreation industries	Other Services

IMPLAN Industry	Description	Industry for Report
479	Hotels and motels- including casino hotels	Other Services
480	Other accommodations	Other Services
481	Food services and drinking places	Other Services
482	Car washes	Other Services
483	Automotive repair and maintenance, except car washes	Other Services
484	Electronic equipment repair and maintenance	Other Services
485	Commercial machinery repair and maintenance	Other Services
486	Household goods repair and maintenance	Other Services
487	Personal care services	Other Services
488	Death care services	Other Services
489	Drycleaning and laundry services	Other Services
490	Other personal services	Other Services
491	Religious organizations	Other Services
492	Grantmaking and giving and social advocacy organizations	Other Services
493	Civic- social- professional and similar organ	Other Services
494	Private households	Other Services
495	Federal electric utilities	Utilities
496	Other Federal Government enterprises	Government
497	State and local government passenger transit	Government
498	State and local government electric utilities	Government
499	Other State and local government enterprises	Government
500	Non-comparable imports	Other Services
501	Scrap	Other Services
502	Used and secondhand goods	Other Services
503	State & Local Education	Education
504	State & Local Non-Education	Government
505	Federal Military	Government
506	Federal Non-Military	Government
507	Rest of the world adjustment to final uses	Other Services
508	Inventory valuation adjustment	Other Services
509	Owner-occupied dwellings	Other Services

Attachment I

IMPLAN Model Data Inputs

Estimating Changes in Demand for Inputs into IMPLAN model

RTI collected data for the Economic Impact Analysis of Section 1 by surveying incubator tenants and graduate firms between June and July of 2007. During this survey, firms were asked to report the number of Full-Time Equivalent (FTE) employees currently working in their organizations, to briefly describe the product or service provided by their company, and to identify the 4-digit North American Industry Classification System (NAICS) code that best describes the industry/sector in which their firm operates.

Out of the 157 companies responding to the survey (employing 1,131 FTEs in 2006), only 132 incubator tenants or graduates (employing 988 FTEs in 2006) responded to these questions.[52] The information they provided would serve as the primary inputs into RTI's economic impact analysis using the IMPLAN model (described in Section 2.3.1) However, the IMPLAN model has its system for classifying industries/sectors that is different from NAICS. Therefore, to use the IMPLAN model we had to re-classify each of the 988 FTEs, from NAICS codes to IMPLAN codes (see **Attachment H** for a listing of all 509 IMPLAN sector codes).

Tables I-1 and **I-2** present the results of the re-classification process for both current incubator tenants and graduates. To understand the steps involved with making this conversion, consider the following example. Nineteen current incubator tenants reported occupying the Computer Systems Design and Related Services (NAICS code 5415). These companies employed a combined total of 91 FTEs. To re-assign these 91 FTEs from NAICS 5415 to the proper IMPLAN industries, RTI used an IMPLAN-to-NAICS crosswalk that linked each NAICS code with a corresponding IMPLAN code. However, this crosswalk did not always provide a 1-to-1 match. For example, one NAICS code could correspond to several different IMPLAN codes. As a result, RTI had to establish a rule for distributing FTEs across IMPLAN sectors.

In the case of NAICS 5415, RTI identified three corresponding IMPLAN codes (441, 442, 443). Next, RTI assumed that the 91 FTEs reported by these respondents would be distributed across IMPLAN codes in proportion to the amount of employment in Maryland associated with each code. For example, if Maryland employed 2.5 times more workers in IMPLAN sector 441 than in 442, then 4 times more of the 6 employees would be assigned to 441 than 442. To perform this distribution, RTI obtained the Maryland employment data for all three sectors from the IMPLAN model's database. Next, this employment in all three industries was added together (105,710 employees for sectors 441, 442, and 443). Finally, employment in each industry was divided by this total to obtain the proper proportions for distribution. For example, 67% of the 91 employees were assigned to IMPLAN sector 441 (71,232/105,710 = 0.65).

A similar procedure was conducted for all 988 employees. However, there were some exceptions. Three NAICS codes did not have IMPLAN codes assigned to them in the crosswalk we were using (NAICS 2361, 9211, 92811). In these cases, we had to identify an IMPLAN code based on Census descriptions of those NAICS codes and from the company descriptions provided by the respondents themselves.

Also, some companies provided sufficient descriptions of their company activities that RTI was able to associate their employees with a single IMPLAN code, even if the NAICS code they reported corresponded to several IMPLAN codes. For example, two current incubator tenants, employing 3 employees each, reported operating in the Computer and Peripheral Equipment Manufacturing (NAICS 3341). While four IMPLAN codes were associated with this NAICS (302, 303, 304, and 305), we were able to associate each company with single IMPLAN codes (302 and 305). This was done for eight NAICS codes (3332, 3399, 3345, 3359, 3259, 3341, 3342, and 5419)

[52] Five additional companies responded to this portion of the survey, however, they did not reveal whether they were an incubator graduate or an incubator tenant. As a result, these five companies, employing 16.5 total FTEs, were excluded from the Economic Impact Analysis.

Table I-1. Current Incubator Tenants: Assignment of Reported Survey Employment to IMPLAN Industries

NAICS	Companies Reporting this NAICS	IMPLAN Industry	IMPLAN Industry Description	Total IMPLAN Employees	Share of NAICS	Survey Employees Assigned to IMPLAN Industry
3399	3	381	Sporting and athletic goods manufacturing	NA	NA	2.0[a]
		389	Buttons, pins, and all other miscellaneous manufacturing	NA	NA	15.0[a]
3345	2	313	Electromedical apparatus manufacturing	218	100%	25.0
3359	1	343	Miscellaneous electrical equipment manufacturing	NA	NA	2.0[a]
3341	2	302	Electronic computer manufacturing	NA	NA	3.0[a]
		305	Other computer peripheral equipment manufacturing	NA	NA	3.0[a]
3342	1	308	Other communications equipment manufacturing	NA	NA	1.0[a]
5415	19	441	Custom computer programming services	71,232	67%	61.3
		442	Computer systems design services	28,285	27%	24.3
		443	Other computer-related services, including facilities management	6,193	6%	5.3
5419	6	450	All other miscellaneous professional and technical services	NA	NA	25.0[a]
3111	1	46	Dog and cat food manufacturing	108	20%	0.4
		47		443	80%	1.6
3114	1	60	Frozen food manufacturing	396	51%	3.1
		61	Fruit and vegetable canning and drying	382	49%	2.9
5416	13	444	Management consulting services	31,147	85%	34.4
		445	Environmental and other technical consulting	5,501	15%	6.1
2361	1	33	New residential 1—unit structures—all	64,051	100%	3.0
3254	1	160	Pharmaceutical and medicine manufacturing	5,000	100%	13.0
4239	1	390	Wholesale trade	97,136	100%	1.0
5112	2	417	Software publishers	1,822	100%	14.0
5161	1	423	Information services	2,360	100%	3.0
5179	2	422	Telecommunications	22,147	100%	13.0
5182	2	424	Data processing services	7,228	100%	65.0
5191	7	423	Information services	2,360	100%	57.0

NAICS	Companies Reporting this NAICS	IMPLAN Industry	IMPLAN Industry Description	Total IMPLAN Employees	Share of NAICS	Survey Employees Assigned to IMPLAN Industry
5413	4	439	Architectural and engineering services	54,846	100%	16.0
5414	1	440	Specialized design services	4,003	100%	1.0
5417	15	446	Scientific research and development services	45,722	100%	46.3
5418	4	447	Advertising and related services	9,438	100%	24.0
5511	1	451	Management of companies and enterprises	11,958	100%	3.0
5613	1	454	Employment services	66,197	100%	3.0
6114	1	463	Other educational services	18,894	100%	24.0
6117	1	463	Other educational services	18,894	100%	6.0
6231	1	468	Nursing and residential care facilities	65,769	100%	0.0
6233	1	468	Nursing and residential care facilities	65,769	100%	1.5
8139	1	493	Civic- social- professional and similar organizations	33,247	100%	1.0
9211	1	506	Federal non-military	115,359	100%	14.0
9281	1	506	Federal non-military	115,359	100%	1.0
Totals	99					525

[a] RTI assigned employment using survey responses describing the company's primary economic activities.

Table I-2. Graduate Firms: Assignment of Reported Survey Employment to IMPLAN Industries.

NAICS	Companies Reporting this NAICS	IMPLAN Industry	IMPLAN Industry Description	Total IMPLAN Employees	Share of NAICS	Survey Employees Assigned to IMPLAN Industry
3332	1	269	All other industrial machinery manufacturing	22	100%	10
5415	4	443	Other computer related services—including facilities management	6,193	6%	2
		442	Computer systems design services	28,285	27%	8
		441	Custom computer programming services	71,232	67%	20
5416	2	445	Environmental and other technical consulting	5,501	15%	2
		444	Management consulting services	31,147	85%	9
3254	1	160	Pharmaceutical and medicine manufacturing	5,000	100%	80
5112	2	417	Software publishers	1,822	100%	12
5161	1	423	Information services	2,360	100%	5
5181	2	423	Information services	2,360	100%	4
5411	1	437	Legal services	29,893	100%	0
5413	1	439	Architectural and engineering services	54,846	100%	16
5417	14	446	Scientific research and development services	45,722	100%	283
5418	2	447	Advertising and related services	9,438	100%	7
7131	1	478	Other amusement, gambling, and recreation industries	17,193	100%	6
Totals	32					463

After RTI re-classified the 988 FTEs using the IMPLAN sector scheme, we turned our attention to using this survey information as a means of associating all incubator employees with individual industries. An estimate of all full-time and part-time employees working for incubator graduates and tenants was obtained from the 2006 Maryland Business Incubator Association (MBIA) Survey. This survey identified 5,375 full-time and part-time employees -- 1,449 individuals employed by current tenants and 3,925 individuals employed by graduates.

To associate each of these 5,375 employees with an individual industry, RTI assumed that the distribution of all incubator employees across industries was identical to the distribution observed in our survey. For example, if 0.6% of the 525 FTEs employed by current incubator tenants identified in RTI's survey belong in the Electronic Computer Manufacturing industry/sector, then 0.6% of the 1,449 current incubator employees identified in the MBIA survey would also be associated with the electronic computer industry/sector. **Tables I-3** and **I-4** report the results of this distribution procedure for both incubator tenants and graduates. **Table I-5** reports the sum of incubator tenant and graduate employment by industry. These total estimates served as the inputs (direct effects) used in the IMPLAN analysis described in Section 2.3.1.

Table I-3. Current Occupants: Distributing Total Employees across Industries Based on Survey Results

IMPLAN Industry	IMPLAN Industry Description	Survey Employees	Percentage of Total	Estimated Incubator Employees
33	New residential 1—unit structures—all	3	0.6%	8
46	Dog and cat food manufacturing	0	0.1%	1
47	Other animal food manufacturing	2	0.3%	4
60	Frozen food manufacturing	3	0.6%	8
61	Fruit and vegetable canning and drying	3	0.6%	8
160	Pharmaceutical and medicine manufacturing	13	2.5%	36
302	Electronic computer manufacturing	3	0.6%	8
305	Other computer peripheral equipment manufacturing	3	0.6%	8
308	Other communications equipment manufacturing	1	0.2%	3
313	Electromedical apparatus manufacturing	25	4.8%	69
343	Miscellaneous electrical equipment manufacturing	2	0.4%	6
381	Sporting and athletic goods manufacturing	2	0.4%	6
389	Buttons, pins, and all other miscellaneous manufacturing	15	2.9%	41
390	Wholesale trade	1	0.2%	3
417	Software publishers	14	2.7%	39
422	Telecommunications	13	2.5%	36
423	Information services	60	11.4%	166
424	Data processing services	65	12.4%	179
439	Architectural and engineering services	16	3.0%	44
440	Specialized design services	1	0.2%	3
441	Custom computer programming services	61	11.7%	169
442	Computer systems design services	24	4.6%	67
443	Other computer related services- including facilities management	5	1.0%	15
444	Management consulting services	34	6.6%	95

445	Environmental and other technical consulting	6	1.2%	17
446	Scientific research and development services	46	8.8%	128
447	Advertising and related services	24	4.6%	66
450	All other miscellaneous professional and technical services	25	4.8%	69
451	Management of companies and enterprises	3	0.6%	8
454	Employment services	3	0.6%	8
463	Other educational services	30	5.7%	83
468	Nursing and residential care facilities	2	0.3%	4
493	Civic, social, professional, and similar organizations	1	0.2%	3
506	Federal non-military	15	2.9%	41
Total		525	100%	1,449

Table I-4. Graduate Firms: Distributing Total Employees across Industries Based on Survey Results

IMPLAN Industry	IMPLAN Description	Survey Employees	Percentage of Total	Estimated Incubator Employees
160	Pharmaceutical and medicine manufacturing	80	17.3%	679
269	All other industrial machinery manufacturing	10	2.2%	85
417	Software publishers	12	2.6%	102
423	Information services	9	1.9%	76
437	Legal services	0	0.0%	—
439	Architectural and engineering services	16	3.5%	136
441	Custom computer programming services	20	4.2%	166
442	Computer systems design services	8	1.7%	66
443	Other computer related services, including facilities management	2	0.4%	14
444	Management consulting services	9	2.0%	79
445	Environmental and other technical consulting services	2	0.4%	14
446	Scientific research and development services	283	61.1%	2,397
447	Advertising and related services	7	1.5%	59
478	Other amusement, gambling, and recreation industries	6	1.3%	51
Total		463	100%	3,925

Table I-5. Direct Impacts of the Incubator Firms on Maryland Economy

IMPLAN	IMPLAN Description	Employees
33	New residential 1—unit structures—all	8.3
46	Dog and cat food manufacturing	1.1
47	Other animal food manufacturing	4.4
60	Frozen food manufacturing	8.4
61	Fruit and vegetable canning and drying	8.1
160	Pharmaceutical and medicine manufacturing	35.9
171	Other miscellaneous chemical product manufacturing	≤0.1
302	Electronic computer manufacturing	8.3
305	Other computer peripheral equipment manufacturing	8.3
308	Other communications equipment manufacturing	2.8

IMPLAN	IMPLAN Description	Employees
313	Electromedical apparatus manufacturing	69.0
343	Miscellaneous electrical equipment manufacturing	5.5
381	Sporting and athletic goods manufacturing	5.5
389	Buttons, pins, and all other miscellaneous manufacturing	41.4
390	Wholesale trade	2.8
417	Software publishers	38.6
422	Telecommunications	35.9
423	Information services	165.5
424	Data processing services	179.3
439	Architectural and engineering services	44.1
440	Specialized design services	2.8
441	Custom computer programming services	169.1
442	Computer systems design services	67.1
443	Other computer-related services including facilities management	14.7
444	Management consulting service	95.0
445	Environmental and other technical consulting	16.8
446	Scientific research and development services	127.6
447	Advertising and related services	66.2
450	All other miscellaneous professional and technical services	69.0
451	Management of companies and enterprises	8.3
454	Employment services	8.3
463	Other educational services	82.8
468	Nursing and residential care facilities	4.1
493	Civic, social, professional, and similar organizations	2.8
506	Federal non-military	41.4
160	Pharmaceutical and medicine manufacturing	678.9
269	All other industrial machinery manufacturing	84.9
417	Software publishers	101.8
423	Information services	76.4
437	Legal services	≤0.1
439	Architectural and engineering services	135.8
441	Custom computer programming services	165.8
442	Computer systems design services	65.9
443	Other computer related services, including facilities management	14.4
444	Management consulting services	79.3
445	Environmental and other technical consulting services	14.0
446	Scientific research and development services	2,397.4
447	Advertising and related services	59.4
478	Other amusement, gambling, and recreation industries	50.9
Total		**5,374.0**

Attachment J

Client Survey

Maryland TEDCO

Preview Worksheet for test14 2007 / Primary

You can print this worksheet if necessary. DO NOT SUBMIT THIS DOCUMENT BY MAIL UNLESS APPROVED TO DO SO. Please complete your survey electronically at http://www.policyoneresearch.com/survey/mdtedco

1. Please provide the following contact information (of the person completing the survey).

a) First name

b) Last name:

c) Phone number:

d) Email address:

2. In which incubator is (was) your firm located? (choose one)

- ◯ Maryland Technology Development Center
- ◯ Silver Spring Innovation Center
- ◯ Wheaton Business Incubator
- ◯ Emerging Technology Centers
- ◯ Technology Advancement Program
- ◯ techcenter@UMBC
- ◯ Technical Innovation Center
- ◯ Neotech Incubator
- ◯ Prince George's County Technology Assistance Center
- ◯ Garrett Information Enterprise Center
- ◯ Chesapeake Innovation Center
- ◯ Frederick Innovative Technology Centers, Inc.
- ◯ Calvert County Incubator
- ◯ Charles County Incubator
- ◯ Tawes Science/Technology Incubator, Frostberg State University

3. Did your firm respond to TEDCO's first economic impact survey that was conducted in 2001?

- ◯ Yes
- ◯ No
- ◯ Don't know

4. Approximately when was your company founded?

a) Month (chose one)

- ◯ Jan
- ◯ Feb

- Mar
- Apr
- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec

b) Year (YYYY)

5. When did your firm enter (or become a client) of the Maryland incubator?

a) Month (chose one)

- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec

b) Year (YYYY)

6. How many full-time equivalent employees, (FTE's), were employed by your firm at each of the following calendar year-ends?(click link below for FTE definition)

a) FTE's on December 31, 2005:

b) FTE's on December 31, 2006:

c) FTE's on May 31, 2007:

If you had no FTE's at a given point of time, enter "0" (zero).
Definition Of FTE

7. Of the new employees hired during each of the following years, how many relocated to Maryland from outside the state to work at your firm? (indicate actual number of employees in whole number regardless whether full-time or part-time):

a) # employees relocating to Maryland in calendar year 2005:

b) # employees relocating to Maryland in calendar year 2006:

c) # employees relocating to Maryland in thus far in calendar year 2007:

If no employees relocated to Maryland in a given year, enter "0" (zero).

8. Do all of your employees reside in Maryland? ◯ Yes ◯ No

If 'Yes', go to Question #10

9. Indicate how many employees reside in each of the states (indicate actual number of employees in whole number regardless whether full-time or part-time):

a) Delaware:

b) District of Columbia:

c) New Jersey:

d) Pennsylvania:

e) Virginia:

f) West Virginia:

g) All other NON-MARYLAND:

If no employees reside in the given state you may enter "0" (zero).

10. Approximately, what was your total annual payroll for the following periods including salaries paid to principals?

a) Jan 1, 2005 through Dec 31 2005:

b) Jan 1, 2006 through Dec 31 2006:

Round to nearest whole number.

11. Indicate your North American Industrial Classification System (NAICS) code? (Your NAICS code was assigned during your incorporation process and is included on your filings with the IRS, OSHA, SBA, and other federal agencies). CLICK ON "pick" TO SELECT NAICS. You can also search by keyword. Pick

Your assigned NAICS Code consists of 6 digits, but please report only the first 4 digits for purposes of this survey.

12. Briefly, how would you describe your firm's principal economic activity (e.g. molecular diagnostics instrumentation)?

13. Approximately, what was your annual (not total) funding/revenues for the following years? Include revenues from sales and services, grants, loans, contracts, and other funds that were not "in-kind".

a) Annual funding from Jan 1 2005 through Dec 31 2005:

b) Annual funding from Jan 1 2006 through Dec 31 2006:

Reasonable approximations will suffice. Round to the nearest whole number.

14. Please apportion your 2006 annual funding/revenue by the regions from which it was sourced. Enter a number between 0 and 100 with no percent sign.

a) Percent from Maryland sources:

b) Percent from U.S sources inlcuding federal funding (but excluding Maryland):

c) Percent from international sources (outside U.S.):

The total of a)-c) should equal 100. Estimate as closely as possible.

15. Is your firm currently profitable?

- Yes
- No
- Not applicable

If 'Yes', go to Question #17
If 'Not applicable', go to Question #17

16. Do you expect your firm to be profitable within the next 2 years? Yes No

17. Do you manufacture a product for sale? Yes No

If 'No', go to Question #23

18. Do you maintain your own facility for manufacturing? Yes No

If 'No', go to Question #20

19. Is the facility located in Maryland? Yes No

20. Do you outsource manufacturing to a subcontractor(s)? ◯ Yes ◯ No

If 'No', go to Question #23

21. Is/are your manufacturing subcontractor(s) all located in Maryland? ◯ Yes ◯ No

If 'Yes', go to Question #23

22. For your manufacturing subcontractor(s)) located outside of Maryland, approximately what percent of your total 2006 revenue was provided to that/those subcontractor(s)?

Enter a whole number between 0 and 100 with no percent sign.

23. Excluding manufacturing, did your firm outsource any of the work that is directly related to your firm's primary economic activity in 2006? ◯ Yes ◯ No

If 'No', go to Question #26

24. Was any of that non-manufacturing work outsourced to individuals or businesses located outside of Maryland? ◯ Yes ◯ No

If 'No', go to Question #26

25. Approximately what percent of your total 2006 revenue was provided to non-manufacturing sources outside of Maryland?

Enter a whole number between 0 and 100 with no percent sign.

26. Is your firm still in business? ◯ Yes ◯ No

27. Is your firm a current incubator client (tenant) or a graduate? ◯ Current ◯ Graduate

Please note: Current virtual and affiliate companies are considered CURRENT incubator clients for purposes of this survey.

If 'Graduate', go to Question #48

28. Does your firm have an established time frame for exiting the incubator (i.e. a greater than 75% probability of concluding a set plan for exiting the incubator)? ◯ Yes ◯ No

If 'No', go to Question #34

29. When do you expect to exit the incubator?

a) Month (chose one)

◯ Jan
◯ Feb
◯ Mar
◯ Apr
◯ May
◯ Jun
◯ Jul
◯ Aug

- Sep
- Oct
- Nov
- Dec

b) Year (YYYY)

30. Does your firm intend to relocate to another county in Maryland?

- Yes
- No

If 'No', go to Question #32

31. To which county does your firm intend to relocate? (Choose one)

- Allegany
- Anne Arundel
- Baltimore
- Calvert County
- Caroline
- Carroll
- Cecil
- Charles
- Dorchester
- Frederick
- Garrett
- Harford
- Howard
- Kent
- Montgomery
- Prince George's
- Queen Anne's
- St. Mary's
- Somerset
- Talbot
- Washington
- Wicomico
- Worcester

After answering the above question, go to Question #35

32. Does your firm intend to relocate to another state?

- Yes
- No

If 'No', go to Question #35

33. To which state does your firm intend to relocate and why?

a) Which state

- Alabama
- Alaska

- Arizona
- Arkansas
- California
- Colorado
- Connecticut
- Delaware
- District of Columbia
- Florida
- Georgia
- Hawaii
- Idaho
- Illinois
- Indiana
- Iowa
- Kansas
- Kentucky
- Louisiana
- Maine
- Massachusetts
- Michigan
- Minnesota
- Mississippi
- Missouri
- Montana
- Nebraska
- Nevada
- New Hampshire
- New Jersey
- New Mexico
- New York
- North Carolina
- North Dakota
- Ohio
- Oklahoma
- Oregon
- Pennsylvania
- Rhode Island
- South Carolina
- South Dakota
- Tennessee
- Texas
- Utah
- Vermont
- Virginia
- Washington

- West Virginia
- Wisconsin
- Wyoming
- Not Sure

b) Why?

Choose one or "not sure" (which is last on drop down list)

After answering the above question, go to Question #35

34. Reflecting on your firm's current plans, approximately when do you think your firm may exit the incubator? (YYYY)

Leave blank if it is not possible for you to speculate on incubator departure plans at this time.

35. On a scale of 0 to 4, where 0 equals "not important at all" " to 4 equals "extremely important", how important has your incubator experience been to the success of your company?

- 0-not important at all
- 1
- 2
- 3
- 4-extremely important

36. For each of the following incubator services, please indicate how important they are to your firm on a scale of 0 to 4 where 0 equals "not important at all" to 4 equals "extremely important". Indicate n/o if the service is not offered by the incubator.

<< 0 = Not important at all ... 4 = Extremely important >>

a) Legal clinic or other service relating to legal issues

- n/o
- 0
- 1
- 2
- 3
- 4

b) Connections with funding sources such as grants and/or equity investors

- n/o
- 0
- 1
- 2

- 3
- 4

c) Training programs or workshops

- n/o
- 0
- 1
- 2
- 3
- 4

d) Individualized business counseling; business plan development, marketing assistance, financing advice, strategies, etc…

- n/o
- 0
- 1
- 2
- 3
- 4

e) Access to mentors and professional service providers

- n/o
- 0
- 1
- 2
- 3
- 4

f) Networking among incubator companies through exchanges of experiences

- n/o
- 0
- 1
- 2
- 3
- 4

g) Shared office facilities

- n/o
- 0
- 1
- 2
- 3
- 4

h) Shared biotech equipment

- n/o
- 0
- 1
- 2

- 3
- 4

i) Space that is functional, affordable, and on flexible terms

- n/o
- 0
- 1
- 2
- 3
- 4

j) Access to university Intellectual Property and the Tech Transfer office

- n/o
- 0
- 1
- 2
- 3
- 4

37. For each of the following services not provided by the incubator indicate yes if you "wish it were provided" and no if you "do not care if it were provided". Indicate n/a if the service is currently provided by the incubator.

a) Legal clinic or other services relating to legal issues

- Yes
- No
- n/a

b) Connections with funding sources such as grants and/or equity investors

- Yes
- No
- n/a

c) Training programs or workshops

- Yes
- No
- n/a

d) Individualized business counseling; business plan development, marketing assistance, financing advice, strategies, etc…

- Yes
- No
- n/a

e) Access to mentors and professional services providers

- Yes
- No
- n/a

f) Networking among incubator companies through exchanges of experiences
- ◯ Yes
- ◯ No
- ◯ n/a

g) Shared office facilities
- ◯ Yes
- ◯ No
- ◯ n/a

h) Shared biotechnology equipment
- ◯ Yes
- ◯ No
- ◯ n/a

i) Space that is functional, affordable, and on flexible terms
- ◯ Yes
- ◯ No
- ◯ n/a

j) Access to university Intelectual Property and the Technology Transfer Office
- ◯ Yes
- ◯ No
- ◯ n/a

38. Specify other services not listed in the previous question that are not currently provided but which you would like to see provided:

39. Has your incubator tenancy/affiliation affected your company's ability to raise capital (any degree of affect, however small, should count as an affect)?
- ◯ Improved ability
- ◯ Hindered ability
- ◯ Had no effect
- ◯ Not applicable

40. Has your incubator tenancy/affiliation affected your company's ability to license technology from a university (any degree of affect, however small, should count as an affect)?
- ◯ Improved ability
- ◯ Hindered ability
- ◯ Had no effect
- ◯ Not applicable

41. Does the incubator have an equity or royalty stake in your company?

◯ Yes ◯ No

If 'No', go to Question #44

42. Does this equity/royalty stake improve, hamper, or have no effect on your firm's ability to procure venture capital investment?

◯ Improve
◯ No effect
◯ Hamper

43. Did the incubator's equity/royalty stake act as an incentive, disincentive, or have no impact on your firm's decision to locate in the incubator?

◯ Incentive
◯ Disinecentive
◯ No impact

44. For each of the following potential barriers to success that your company might face after graduation, indicate how serious you think they will be for your company on a scale of 0 to 4 where 0 equals "not serious at all" to 4 equals "extremely serious".

<< 0 = Not serious at all ... 4 = Extremely serious >>

a) Lack of funding-equity investment funds

◯ 0 ◯ 1 ◯ 2 ◯ 3 ◯ 4

b) Lack of publicly available grant funds

◯ 0 ◯ 1 ◯ 2 ◯ 3 ◯ 4

c) Lack of management/business expertise(high-level management-CEO)

◯ 0 ◯ 1 ◯ 2 ◯ 3 ◯ 4

d) Business climate/market considerations

◯ 0 ◯ 1 ◯ 2 ◯ 3 ◯ 4

e) Lack of appropriate space in which to locate

- 0
- 1
- 2
- 3
- 4

f) Lack of affordable space in which to locate

- 0
- 1
- 2
- 3
- 4

g) Lack of trained workforce

- 0
- 1
- 2
- 3
- 4

h) Access to clinical trials

- 0
- 1
- 2
- 3
- 4

45. Describe any other potential barriers to success that your company might face after graduation that would seriously affect your company:

46. For each of the following services or facilities, indicate how important they would be to your company after graduation from the incubator on a scale of 0 to 4 where 0 equals "not important at all" and 4 equals "extremely important".

<< 0 = Not important at all ... 4 = Extremely important >>

a) Customizable and affordable biotech space

- 0
- 1
- 2

- 3
- 4

b) Customizable and affordable IT space

- 0
- 1
- 2
- 3
- 4

c) Business development mentoring and consulting

- 0
- 1
- 2
- 3
- 4

d) Access to trained workforce

- 0
- 1
- 2
- 3
- 4

e) Management skill development

- 0
- 1
- 2
- 3
- 4

f) Wet lab facilities

- 0
- 1
- 2
- 3
- 4

g) General business mentoring

- 0
- 1
- 2
- 3
- 4

h) Networking with other companies

- 0
- 1
- 2

- 3
- 4

i) Reduced-rent office space

- 0
- 1
- 2
- 3
- 4

j) Assistance with raising equity capital

- 0
- 1
- 2
- 3
- 4

k) Loans for fitting out space

- 0
- 1
- 2
- 3
- 4

47. Describe any other services or facilities that would be important to your company after graduation from the incubator:

After answering the above question, go to Question #70

48. When did your firm exit the incubator?

a) Month (chose one)

- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug
- Sep
- Oct

- Nov
- Dec

b) Year (YYYY)

49. Is your firm still headquartered in Maryland? Yes No

If 'No', go to Question #53

50. Did your firm relocate to a different Maryland county from the one in which your incubator was relocated? Yes No

If 'No', go to Question #55

51. To which county did your firm relocate? (Choose one)

- Allegany
- Anne Arundel
- Baltimore
- Calvert County
- Caroline
- Carroll
- Cecil
- Charles
- Dorchester
- Frederick
- Garrett
- Harford
- Howard
- Kent
- Montgomery
- Prince George's
- Queen Anne's
- St. Mary's
- Somerset
- Talbot
- Washington
- Wicomico
- Worcester

52. Why did your firm relocate to this county?

After answering the above question, go to Question #55

53. To which state did your firm relocate?

- Alabama
- Alaska
- Arizona
- Arkansas
- California
- Colorado
- Connecticut
- Delaware
- District of Columbia
- Florida
- Georgia
- Hawaii
- Idaho
- Illinois
- Indiana
- Iowa
- Kansas
- Kentucky
- Louisiana
- Maine
- Massachusetts
- Michigan
- Minnesota
- Mississippi
- Missouri
- Montana
- Nebraska
- Nevada
- New Hampshire
- New Jersey
- New Mexico
- New York
- North Carolina
- North Dakota
- Ohio
- Oklahoma

- Oregon
- Pennsylvania
- Rhode Island
- South Carolina
- South Dakota
- Tennessee
- Texas
- Utah
- Vermont
- Virginia
- Washington
- West Virginia
- Wisconsin
- Wyoming
- Not Sure

54. Why is your firm no longer headquartered in Maryland?

55. On a scale of 0 to 4, where 0 equals "not important at all" " to 4 equals "extremely important", how important was your incubator experience to the success of your company?

- 0-not important at all
- 1
- 2
- 3
- 4-extremely important

56. For each of the following incubator services, please indicate how important they were to your firm on a scale of 0 to 4 where 0 equals "not important at all" to 4 equals "extremely important". Indicate n/o if the service was not offered by the incubator.

<< 0 = Not important at all ... 4 = Extremely important >>

a) Legal clinic or other service relating to legal issues

- n/o
- 0
- 1
- 2
- 3
- 4

b) Connections with funding sources such as grants and/or equity investors

- n/o
- 0
- 1
- 2
- 3
- 4

c) Training programs or workshops

- n/o
- 0
- 1
- 2
- 3
- 4

d) Individualized business counseling; business plan development, marketing assistance, financing advice, strategies, etc…

- n/o
- 0
- 1
- 2
- 3
- 4

e) Access to mentors and professional service providers

- n/o
- 0
- 1
- 2
- 3
- 4

f) Networking among incubator companies through exchanges of experiences

- n/o
- 0
- 1
- 2
- 3
- 4

g) Shared office facilities

- n/o
- 0
- 1
- 2
- 3
- 4

h) Shared biotech equipment
- n/o
- 0
- 1
- 2
- 3
- 4

i) Space that is functional, affordable, and on flexible terms
- n/o
- 0
- 1
- 2
- 3
- 4

j) Access to university Intellectual Property and the Tech Transfer office
- n/o
- 0
- 1
- 2
- 3
- 4

57. For each of the following services not provided by the incubator indicate yes if you "wish it had been provided" and no if you "do not care if it had been provided". Indicate n/a if the service was provided by the incubator.

a) Legal clinic or other services relating to legal issues
- Yes
- No
- n/a

b) Connections with funding sources such as grants and/or equity investors
- Yes
- No
- n/a

c) Training programs or workshops
- Yes
- No
- n/a

d) Individualized business counseling; business plan development, marketing assistance, financing advice, strategies, etc…
- Yes
- No
- n/a

e) Access to mentors and professional services providers
- Yes
- No
- n/a

f) Networking among incubator companies through exchanges of experiences
- Yes
- No
- n/a

g) Shared office facilities
- Yes
- No
- n/a

h) Shared biotechnology equipment
- Yes
- No
- n/a

i) Space that is functional, affordable, and on flexible terms
- Yes
- No
- n/a

j) Access to university Intelectual Property and the Technology Transfer Office
- Yes
- No
- n/a

58. Specify other services not listed in the previous question that were not provided but which you would have liked to see provided:

59. Did your incubator tenancy/affiliation affect your company's ability to raise capital (any degree of affect, however small, should count as an affect)?
- Improved ability
- Hindered ability
- Had no effect
- Not applicable

60. Did your incubator tenancy/affiliation affect your company's ability to license technology from a university (any degree of affect, however small, should count as an affect)?

- Improved ability
- Hindered ability
- Had no effect
- Not applicable

61. Did your incubator have an equity or royalty stake in your company?

- Yes
- No

If 'No', go to Question #64

62. Did this equity/royalty stake improve, hamper, or have no effect on your firm's ability to procure venture capital investment?

- Improve
- No effect
- Hamper

63. Did the incubator's equity/royalty stake act as an incentive, disincentive, or have no impact on your firm's decision to locate in the incubator?

- Incentive
- Disinecentive
- No impact

64. For each of the following barriers to success that your company might be facing since graduation, indicate how serious it has been for your company on a scale of 0 to 4 where 0 equals "not serious at all" to 4 equals "extremely serious".

<< 0 = Not serious at all ... 4 = Extremely serious >>

a) Lack of funding-equity investment funds

- 0
- 1
- 2
- 3
- 4

b) Lack of publicly available grant funds

- 0
- 1
- 2
- 3
- 4

c) Lack of management/business expertise(high-level management-CEO)

- 0
- 1
- 2
- 3
- 4

d) Business climate/market considerations

- 0
- 1
- 2
- 3
- 4

e) Lack of appropriate space in which to locate

- 0
- 1
- 2
- 3
- 4

f) Lack of affordable space in which to locate

- 0
- 1
- 2
- 3
- 4

g) Lack of trained workforce

- 0
- 1
- 2
- 3
- 4

h) Access to clinical trials

- 0
- 1
- 2
- 3
- 4

65. Describe any other potential barriers to success that your company has faced after graduation that seriously affect your company:

66. For each of the following other services/resources indicate "yes" or "no" if your firm has utilized it to help be successful:

a) Maryland Department of Business & Economic Development (DBED) ◯ Yes ◯ No

b) Maryland Technology Enterprise Institute (MTECH) ◯ Yes ◯ No

c) Small Business Development Centers (SBDC) ◯ Yes ◯ No

d) Maryland Industrial Partnerships Program (MIPS) ◯ Yes ◯ No

e) Technology Councils in the State ◯ Yes ◯ No

f) Manufacturing Extension Partnership (MEP) ◯ Yes ◯ No

g) Technology Transfer Office ◯ Yes ◯ No

67. Describe any other services/resources your firm has utilized to help be successful not listed in the previous question:

68. For each of the following services or facilities, indicate how important they are (or would be if they are not currently available) to your company as an incubator graduate on a scale of 0 to 4 where 0 equals "not important at all" and 4 equals "extremely important".

<< 0 = Not important at all ... 4 = Extremely important >>

a) Customizable and affordable biotech space ◯ 0 ◯ 1 ◯ 2 ◯ 3 ◯ 4

b) Customizable and affordable IT space ◯ 0 ◯ 1 ◯ 2 ◯ 3 ◯ 4

c) Business development mentoring and consulting ◯ 0 ◯ 1 ◯ 2 ◯ 3 ◯ 4

d) Access to trained workforce
- 0
- 1
- 2
- 3
- 4

e) Management skill development
- 0
- 1
- 2
- 3
- 4

f) Wet lab facilities
- 0
- 1
- 2
- 3
- 4

g) General business mentoring
- 0
- 1
- 2
- 3
- 4

h) Networking with other companies
- 0
- 1
- 2
- 3
- 4

i) Reduced-rent office space
- 0
- 1
- 2
- 3
- 4

j) Assistance with raising equity capital
- 0
- 1
- 2
- 3
- 4

k) Loans for fitting out space

- 0
- 1
- 2
- 3
- 4

69. Describe any other services or facilities that would be/are important to your company as an incubator graduate:

70. Provide any additional comments you would like?