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**An Analysis of the Impacts of MIPS Program Spending and the Commercialization of MIPS
Funded Projects on the State of Maryland**

**Prepared by:
Richard Clinch, PhD
Director of Economic Research
The Jacob France Institute
University of Baltimore**

Introduction and Summary

The Maryland Industrial Partnerships (MIPS) program of the Maryland Technology Enterprise Institute (Mtech) retained the Jacob France Institute of the Merrick School of Business at the University of Baltimore (JFI) to analyze the economic impact of the MIPS program and of the commercialization of MIPS-supported technologies that are being produced in the state of Maryland. The goals of this analysis are to:

- Analyze the economic impact of MIPS Research funding;
- Analyze the economic impact of the in-state commercialization of MIPS-supported technologies; and
- Describe the State's return on investment in the MIPS program.

The key findings of this analysis are as follows:

- Over the twenty-five year history of the MIPS program, it has supported 1,032 joint university-industry research collaborations;
- Over these twenty five years, total MIPS program spending of \$37.0 million have been augmented with \$21.7 million in company research support and matching funds, for a total of \$58.7 million in joint university-industry research funding supported by the program;
- This \$58.7 million in research funding is only part of the story of the impacts of MIPS on research at Maryland's public universities. In addition to spending \$21.7 million in direct research support to Maryland campuses, companies made in-kind research and equipment contributions of \$102.7 million and equipment donations of \$2.6 million, an amount almost twice as much as the direct research funding provided;
- In calendar 2011, the MIPS program spent a total of just over \$2.0 million on joint university-industry research. This \$2.0 million in direct expenditures generated \$4.1 million in economic activity in Maryland, supported 28 jobs earning \$1.9 million, and generated almost \$0.2 million in combined state and local government revenues;
- The main mission of the MIPS program is to accelerate the development and commercialization of technology in Maryland by linking the research capacity of Maryland public universities with leading Maryland businesses. The MIPS program tracks the results of the commercialization through its annual economic impact evaluation survey of participating businesses. According to the economic impact data collected by MIPS from these companies, the technology developed and

commercialized in Maryland through the program has had impressive results. Based on this economic impact data, current economic impact data are available for 141 individual MIPS projects with 127 different companies, ranging from Northrop Grumman, to MedImmune (now part of AstraZeneca), to Hughes Network Systems.

- Based on the economic analysis conducted as part of this report, technology developed and commercialized in collaboration with the MIPS program generated over \$3 billion in product sales and supported 3,615 jobs in Maryland in calendar 2011. When the multiplier-based economic impacts associated with this activity are included, the economic impacts associated with the production and sale of these commercialized technologies total \$4.8 billion in economic activity in Maryland, supporting 15,191 jobs earning \$1.1 billion in labor income; and
- The 2011 economic impacts associated with MIPS supported technology generated an estimated \$87.3 million in estimated state revenues in the year 2011 alone.¹ The estimated 2011 state tax revenues associated with the production and sale of MIPS supported technology generates more than the \$37 million *lifetime costs* of the program.

It is clear that by supporting the commercialization of new advanced technologies that have been produced in and created jobs in Maryland; the MIPS program has contributed to Maryland's economic development success. If the \$37.0 million in total MIPS program spending is divided by the estimated 3,615 ongoing jobs supported by MIPS technology, the total state cost per job created is only \$10,236, a very low level of cost per job creation. Even this low cost per direct job created is only part of the story of the economic and commercialization impacts of the MIPS program. According to the MIPS economic impact data collected, the reporting companies have also attracted an additional \$138.9 million² in federal and other grants to further develop the technologies commercialized and these companies have reported \$745.3 million in debt, equity, and venture capital funding to further develop and commercialize MIPS supported technologies. Thus, the \$37.0 million in State of Maryland MIPS spending assisted in catalyzing the development and commercialization of technologies that have attracted \$884.2 million in additional grant, debt, equity, and venture capital funding into Maryland.

¹ The IMPLAN model used estimates combined state and local government revenues. State revenues were estimated based on U.S. Bureau of the Census data on the share of state revenues from each IMPLAN estimated revenue source.

² One company which reported \$170 million in grants revenues was considered an outlier and excluded from this analysis.

MIPS Program Funding – A 25 Year History

The Maryland Industrial Partnerships (MIPS) program accelerates the commercialization of technology in Maryland by jointly funding collaborative R&D projects between companies and University System of Maryland faculty. MIPS is one of the core programs of the Maryland Technology Enterprise Institute (Mtech), a unit of the A. James Clark School of Engineering at the University of Maryland, College Park. The mission of Mtech is to educate the next generation of technology entrepreneurs, create successful technology ventures, and connect Maryland companies with university resources to help them succeed. Founded in 1983, Mtech has had a \$25.7 billion impact on the Maryland economy and helped create or retain more than 5,300 jobs. Top-selling products such as MedImmune's Synagis®, which protects infants from a deadly respiratory disease, and Hughes Communications' HughesNet®, which brings satellite-based, high-speed Internet access to the world, were developed through or enhanced by their programs. Billion dollar companies such as Martek Biosciences and Digene Corporation graduated from Mtech's incubator. Mtech offers three experiential learning programs, 30 entrepreneurship and innovation courses, served to 1,244 enrollees in 2010 for students from pre-college to undergraduate, graduate and executive education.

Through MIPS, Maryland firms have the opportunity to leverage their research and development funds and gain access to the creative talents and extensive research base of the University System of Maryland. MIPS matching funds are awarded on a competitive basis for projects based on proposals submitted jointly by Maryland companies and researchers from any of the 13 University System institutions. The maximum MIPS award for any single project is \$100,000 per year for large and small companies and \$90,000 for start-up firms. Through the MIPS program, two types of projects can receive funding:

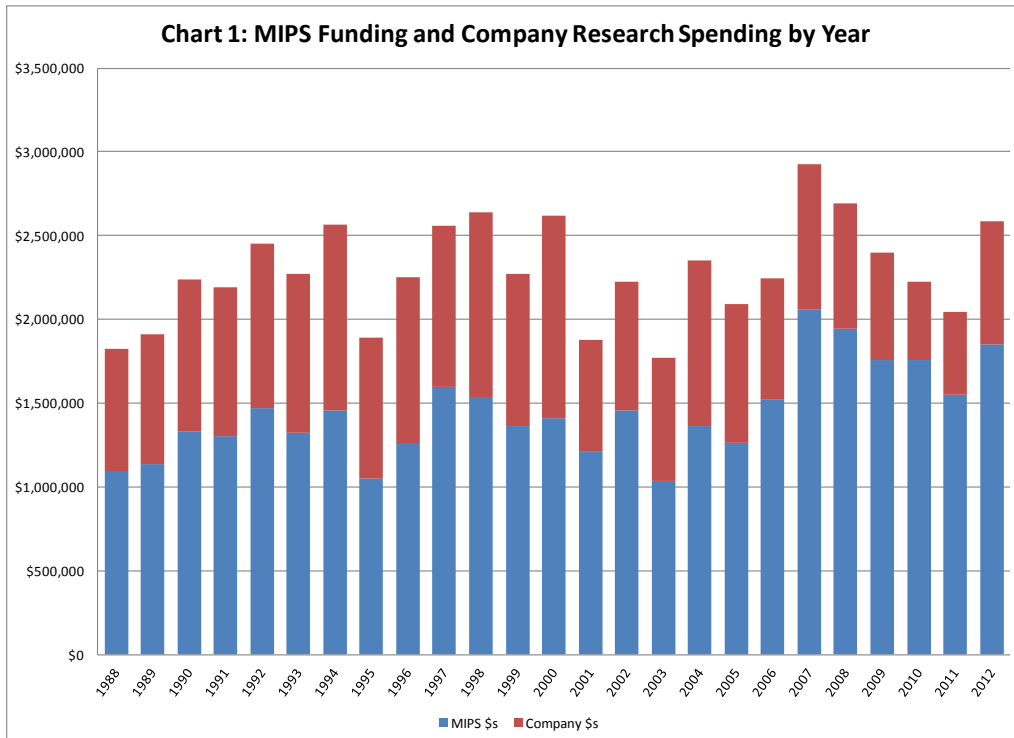
- Research and Development - The research may be in engineering, computer science, physical sciences and life sciences; and
- Education and Training - MIPS also supports projects designed to help a company plan and develop industrial training programs for its employees.

As presented in Table 1, over the twenty-five year history of MIPS, it has supported 1,032 joint university-industry research collaborations. Total MIPS program spending of \$37.0 million have been augmented with \$21.7 million in company research support and matching funds, for a total of \$58.7 million in joint university-industry research funding supported by the program. As presented in Chart 1, MIPS funding has ranged from just over \$1.5 million to almost \$3.0 million per year, over the past 25 years. The \$58.7 million in total (State and private) MIPS research funding is only part of the story of the impact of MIPS on research at Maryland's public universities. In addition to spending \$21.7 million in direct research support to Maryland campuses, companies made in-kind research and equipment contributions of \$102.7 million and equipment donations of \$2.6 million, an amount almost twice as much as the direct research funding provided.

Table 1
MIPS Program - 25 Years of Activity - Projects and Funding by Campus

Campus	# of Projects	MIPS Funding (\$s)	Company Funding (\$s)	Total Funding (\$s)
Total	1,032	\$37,000,763	\$21,709,553	\$58,710,316
Bowie State	3	\$88,893	\$64,120	\$153,013
FED-MIPS	2	\$92,063	\$103,000	\$195,063
Frostburg State	5	\$251,418	\$50,000	\$301,418
Johns Hopkins	17	\$581,980	\$429,223	\$1,011,203
Morgan State	5	\$191,309	\$67,144	\$258,453
Morgan State University	1	\$50,486	\$7,297	\$57,783
Salisbury University	6	\$114,691	\$74,294	\$188,985
Towson University	10	\$315,602	\$142,575	\$458,177
UMB	182	\$7,840,330	\$4,445,577	\$12,285,907
UMBC	108	\$4,099,063	\$2,278,601	\$6,377,664
UMBI	26	\$1,023,306	\$453,000	\$1,476,306
UMCES	19	\$667,050	\$226,666	\$893,716
UMCP	625	\$20,592,769	\$13,167,869	\$33,760,638
UMES	21	\$1,045,912	\$160,643	\$1,206,555
UMUC	2	\$45,891	\$39,544	\$85,435

Source: MIPS



The Economic Contribution of 2011 MIPS Research Spending

In 2011, the MIPS program funded 27 projects with a total budget of \$2,044,210, consisting of \$1,550,594 million in MIPS program spending and \$493,616 in company research support. As presented in Table 2, the \$2.0 million in 2011 MIPS research project funding supported an estimated 12 jobs at participating universities with an estimated \$1.1 million in labor income. The \$2.0 million 2011 MIPS program funding generated an estimated \$0.8 million in *Indirect Impacts*, from in-State purchases from Maryland suppliers, and \$1.3 million in *Induced Impacts*, from the increase local activity generated by the increase in Maryland incomes, for a total increase in Maryland economic activity of \$4.1 million.³ The Maryland economic activity associated with MIPS research supported a total of 28 jobs earning \$1.9 million in labor income and supported an estimated \$184,604 in State and local government revenues.

Table 2
Economic Impact of 2011 MIPS Research Funding
Economic Impacts of Operations
 (Jobs and 2011\$)

Item	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Economic Output (\$s)	\$2,044,210	\$805,560	\$1,262,089	\$4,111,859
Employment (# of Jobs)	12	6	10	28
Labor Income (\$s)	\$1,126,565	\$324,492	\$442,269	\$1,893,326
Average Labor Income per Job (\$s)	\$94,669	\$50,702	\$43,789	\$66,666
Fiscal Impact (\$s)	--	--	--	\$184,604

Source: JFI and IMPLAN

The output impacts of calendar 2011 MIPS research spending are presented by sector in Table 3, the employment impacts by sector in Table 4, and the labor income impacts are presented in Table 5. As presented in these tables, the impacts of the MIPS research spending are concentrated in the professional scientific and technical services, real estate, finance and insurance, and health and social services sectors of the Maryland economy.

³ For a more detailed description of the terms, model, and methodology used in this economic impact analysis, see the methodology section below.

Table 3
Output Impact of
MIPS 2011 Research Funding
By Sector

Item	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Total	<u>\$2,044,210</u>	<u>\$805,559</u>	<u>\$1,262,089</u>	<u>\$4,111,856</u>
Natural Resources	\$0	\$2,483	\$2,654	\$5,137
Mining	\$0	\$2,876	\$958	\$3,834
Utilities	\$0	\$15,400	\$25,819	\$41,219
Construction	\$0	\$68,324	\$10,037	\$78,361
Manufacturing	\$0	\$20,695	\$40,032	\$60,727
Wholesale Trade	\$0	\$11,292	\$47,229	\$58,521
Retail Trade	\$0	\$2,551	\$121,242	\$123,792
Transportation & Warehousing	\$0	\$34,442	\$22,842	\$57,285
Information	\$0	\$57,586	\$52,620	\$110,205
Finance & Insurance	\$0	\$78,359	\$160,676	\$239,035
Real Estate	\$0	\$92,312	\$272,579	\$364,891
Professional Scientific & Technical Services	\$2,044,210	\$212,038	\$50,315	\$2,306,562
Management of Companies	\$0	\$12,627	\$6,562	\$19,189
Administrative & Waste Services	\$0	\$131,130	\$31,291	\$162,421
Educational Services	\$0	\$186	\$28,737	\$28,923
Health & Social Services	\$0	\$8	\$214,495	\$214,503
Arts, Entertainment & Recreation	\$0	\$3,095	\$15,542	\$18,637
Accommodation & Food Services	\$0	\$19,870	\$60,782	\$80,652
Other Services	\$0	\$27,964	\$68,665	\$96,629
Government	\$0	\$12,321	\$29,012	\$41,333

Source: JFI and IMPLAN

Table 4
Employment Impact of the
MIPS 2011 Research Funding
By Sector

Item	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Total	<u>11.9</u>	<u>6.5</u>	<u>10.0</u>	<u>28.4</u>
Natural Resources	0.0	0.1	0.0	0.1
Mining	0.0	0.0	0.0	0.0
Utilities	0.0	0.0	0.0	0.0
Construction	0.0	0.5	0.1	0.6
Manufacturing	0.0	0.1	0.1	0.2
Wholesale Trade	0.0	0.1	0.3	0.4
Retail Trade	0.0	0.0	1.9	1.9
Transportation & Warehousing	0.0	0.3	0.2	0.5
Information	0.0	0.2	0.2	0.4
Finance & Insurance	0.0	0.3	0.8	1.1
Real Estate	0.0	0.5	0.6	1.1
Professional Scientific & Technical Services	11.9	1.5	0.4	13.8
Management of Companies	0.0	0.1	0.0	0.1
Administrative & Waste Services	0.0	2.0	0.5	2.5
Educational Services	0.0	0.0	0.4	0.4
Health & Social Services	0.0	0.0	2.2	2.2
Arts, Entertainment & Recreation	0.0	0.1	0.3	0.4
Accommodation & Food Services	0.0	0.3	1.0	1.3
Other Services	0.0	0.3	0.9	1.2
Government	0.0	0.1	0.1	0.2

Source: JFI and IMPLAN

Table 5
Labor Income Impact of the
MIPS 2011 Research Funding
By Sector

Item	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Total	<u>\$1,126,565</u>	<u>\$324,495</u>	<u>\$442,270</u>	<u>\$1,893,330</u>
Natural Resources	\$0	\$1,069	\$606	\$1,675
Mining	\$0	\$638	\$116	\$754
Utilities	\$0	\$3,396	\$5,722	\$9,118
Construction	\$0	\$29,836	\$4,514	\$34,350
Manufacturing	\$0	\$4,201	\$5,822	\$10,023
Wholesale Trade	\$0	\$5,126	\$21,441	\$26,567
Retail Trade	\$0	\$1,236	\$57,541	\$58,777
Transportation & Warehousing	\$0	\$13,695	\$10,177	\$23,872
Information	\$0	\$12,818	\$11,280	\$24,098
Finance & Insurance	\$0	\$21,811	\$50,513	\$72,324
Real Estate	\$0	\$10,551	\$13,300	\$23,851
Professional Scientific & Technical Services	\$1,126,565	\$117,417	\$28,653	\$1,272,635
Management of Companies	\$0	\$6,942	\$3,607	\$10,549
Administrative & Waste Services	\$0	\$67,050	\$16,302	\$83,352
Educational Services	\$0	\$107	\$17,858	\$17,965
Health & Social Services	\$0	\$4	\$120,992	\$120,996
Arts, Entertainment & Recreation	\$0	\$1,297	\$6,288	\$7,585
Accommodation & Food Services	\$0	\$7,125	\$21,860	\$28,985
Other Services	\$0	\$14,257	\$35,515	\$49,772
Government	\$0	\$5,919	\$10,163	\$16,082

Source: JFI and IMPLAN

The Economic Impact of the Commercialization of MIPS Funded Projects That Have Been Commercialized in Maryland

The MIPS program tracks the results of the development and commercialization of its supported projects through an annual economic impact evaluation survey of participating businesses. The research conducted by the MIPS program has found that MIPS supported technologies have generated \$24.6 billion in cumulative sales over the past 25 years. According to the economic impact data collected by MIPS from these companies, the technology developed and commercialized in Maryland through the program has had impressive results. The MIPS program provided economic impact evaluation survey data for 141 individual MIPS research projects with 127 different companies, ranging from Northrop Grumman, to MedImmune (now part of AstraZeneca) to Hughes Network Systems. In the MIPS Economic Impact Evaluation Form, firms are asked to provide data on the economic impacts associated with each research effort that leads to the development and commercialization of a new product or service. Firms are specifically asked to provide the following information.

Economic Impact for MIPS Dollars. Measurable results: estimate of jobs, increased sales, improved competitiveness, revitalization of an industry, etc. Consider impact relative to company's size and stage of development.

Of the 141 MIPS projects for which economic impact evaluation data were available:

- 50 firms provided data on both the employment and revenues associated with the commercialized product;
- 42 firms provided data on just the employment associated with the product;
- 17 firms provided data on just the revenues associated with the product; and
- 32 firms provided data on other commercialization related impacts.

This analysis of the economic impacts associated with the commercialization of MIPS supported technology focused on the current level of sales and employment associated with each of the commercialized products or services. Firms reported the 2011 level of revenues and/or employment associated with each MIPS supported technology and these were the input to the economic impact analysis conducted.⁴ Because employment data was most widely reported and also the easiest to report for the firms, the economic impact analysis was based on the reported employment level associated with each MIPS supported commercialized product or service. Where employment levels were not reported, but revenues were reported, revenues figures were used.⁵ In the case of the five commercialized projects that accounted for the overwhelming share of total impacts – MedImmune, Hughes Network Systems, Martek, WellDoc and Automated Precision, which together account for 74% of the 2011 employment associated with commercialized MIPS technologies, the IMPLAN estimated revenues were forced to equal the reported revenues, in order to be consistent with past MIPS reports. Economic impact calculations, however, are based on the lower employment-based IMPLAN estimated revenue figures.

⁴ For a more detailed description of the terms, model, and methodology used in this economic impact analysis, see the methodology section below.

⁵ Economic impact analyses can be conducted with the IMPLAN model used based on either employment or revenues.

In 2011, the 141 MIPS supported commercialized technologies had associated employment of 3,615 jobs and generated \$3.1 billion in estimated product sales.⁶ As presented in Table 6, these 3,615 jobs and \$3.1 billion in estimated MIPS supported product sales generated \$4.8 billion in Maryland economic activity, supported a total of 15,191 jobs earning \$1.1 billion in labor income, and support an estimated \$157.8 million in State and local government revenues. These economic impact estimates include \$962.4 million in *Indirect Impacts*, from in-State purchases from Maryland suppliers, and \$758.0 million in *Induced Impacts*, from the increase local activity generated by the increase in Maryland incomes, for a total increase in Maryland economic activity of \$4.8 billion.

Table 6
Economic Impact of
Company Commercialization of MIPS Technology, 2011 EIS Data
Economic Impacts of Company Employment and Revenues
 (Jobs and 2011\$)

Item	Direct	Impact	Indirect Impact	Induced Impact	Total Impact
Output (\$s)	\$3,080,014,072		\$962,389,477	\$757,977,247	\$4,800,380,796
Employment (# of Jobs)		3,615	5,533	6,043	15,191
Labor Income (\$s)	\$476,766,294		\$397,249,586	\$265,610,165	\$1,139,626,045
Average Labor Income per Job (\$s)		\$131,900	\$71,794	\$43,954	\$75,021
Fiscal Impact (\$s)		--	--	--	\$157,825,222
					Estimated State Government Revenues
					\$87,253,338
					Estimated Local Government Revenues
					\$70,571,884

Source: JFI and IMPLAN

The 2011 output impacts of the commercialization of MIPS supported technologies are presented by sector in Table 7, the employment impacts by sector in Table 8, and the labor income impacts are presented in Table 9. As presented in these tables, the impacts of the commercialization, production, and sale of MIPS supported technologies are concentrated in the manufacturing, information, professional scientific and technical services, and real estate sectors of the Maryland economy.

In addition to the employment and product sales associated with the development and commercialization of MIPS supported technologies, the MIPS program also impacts the Maryland economy through the grant, venture capital, debt, and equity funding that participating

⁶ It is impossible to know the extent to which the MIPS program contributed to the actual development or commercialization of each specific technology. Firms were simply asked to provide the available data on the economic impacts – in terms of jobs and/or revenues – associated with the current production and sale of MIPS supported technologies and products. These reported employment and revenue figures were accepted as provided, with the MIPS program engaged in its own efforts to verify the reported figures. For one project, where the estimated employment and revenues seemed too large, the results were dropped from the analysis. As described above, in conducting the economic impact analysis, economic impacts were generated using lower IMPLAN-estimated revenues for the five most successful MIPS-supported commercialized technologies.

companies attract in order to further develop each associated technology. According to the MIPS economic impact data collected, the reporting companies have also attracted an additional \$138.9 million⁷ in federal and other grants to further develop the MIPS supported technologies commercialized and these companies a reported \$745.3 million in debt, equity, and venture capital funding to further develop and commercialize MIPS supported technologies. Thus, the \$37.0 million in State of Maryland MIPS spending assisted in catalyzing the development and commercialization of technologies that have attracted \$884.2 million in additional grant, debt, equity, and venture capital funding into Maryland.

Table 7
Output Impact of
Company Commercialization of MIPS Technology, 2011 EIS Data
By Sector

Item	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Total	<u>\$3,080,014,072</u>	<u>\$962,389,477</u>	<u>\$757,977,247</u>	<u>\$4,800,380,796</u>
Natural Resources	\$134,885	\$820,328	\$1,598,796	\$2,554,009
Mining	\$0	\$1,053,446	\$577,977	\$1,631,423
Utilities	\$580,333	\$24,818,628	\$15,628,587	\$41,027,548
Construction	\$2,565,788	\$21,947,225	\$6,025,106	\$30,538,119
Manufacturing	\$1,811,315,704	\$117,733,451	\$24,202,970	\$1,953,252,125
Wholesale Trade	\$0	\$131,041,116	\$28,690,694	\$159,731,810
Retail Trade	\$0	\$1,456,823	\$72,453,014	\$73,909,837
Transportation & Warehousing	\$0	\$25,620,958	\$13,667,003	\$39,287,961
Information	\$1,244,545,371	\$99,996,875	\$31,734,594	\$1,376,276,840
Finance & Insurance	\$0	\$33,106,488	\$96,677,165	\$129,783,653
Real Estate	\$0	\$57,533,144	\$163,415,322	\$220,948,466
Professional Scientific & Technical Services	\$15,947,404	\$218,623,975	\$30,264,551	\$264,835,930
Management of Companies	\$0	\$140,636,964	\$3,950,430	\$144,587,394
Administrative & Waste Services	\$4,266,083	\$52,268,598	\$18,785,922	\$75,320,603
Educational Services	\$0	\$221,435	\$16,988,088	\$17,209,523
Health & Social Services	\$658,504	\$26,718	\$129,025,529	\$129,710,751
Arts, Entertainment & Recreation	\$0	\$3,234,196	\$9,287,905	\$12,522,101
Accommodation & Food Services	\$0	\$7,012,910	\$36,529,425	\$43,542,335
Other Services	\$0	\$16,551,564	\$41,024,251	\$57,575,815
Government	\$0	\$8,684,635	\$17,449,918	\$26,134,553

Source: JFI and IMPLAN

⁷ One company which reported \$170 million in grants revenues was considered an outlier and excluded from this analysis.

Table 8
Employment Impact of the
Company Commercialization of MIPS Technology, 2011 EIS Data
By Sector

Item	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Total	<u>3,615</u>	<u>5,533</u>	<u>6,043</u>	<u>15,191</u>
Natural Resources	4	13	18	34
Mining	0	7	4	11
Utilities	2	26	17	44
Construction	16	162	50	228
Manufacturing	2,927	199	54	3,179
Wholesale Trade	0	719	157	876
Retail Trade	0	21	1,110	1,131
Transportation & Warehousing	0	243	141	384
Information	521	298	97	916
Finance & Insurance	0	170	496	666
Real Estate	0	254	359	613
Professional Scientific & Technical Services	115	1,525	240	1,881
Management of Companies	0	730	21	750
Administrative & Waste Services	23	771	278	1,072
Educational Services	0	3	244	246
Health & Social Services	6	0	1,317	1,323
Arts, Entertainment & Recreation	0	69	195	264
Accommodation & Food Services	0	117	617	734
Other Services	0	161	551	712
Government	0	48	80	128

Source: JFI and IMPLAN

Table 9
Labor Income Impact of the
Company Commercialization of MIPS Technology, 2011 EIS Data
By Sector

Item	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Total	\$476,766,294	\$397,249,586	\$265,610,165	\$1,139,626,045
Natural Resources	\$22,598	\$191,537	\$364,555	\$578,690
Mining	\$0	\$146,514	\$69,898	\$216,412
Utilities	\$202,709	\$5,498,477	\$3,463,469	\$9,164,655
Construction	\$949,390	\$9,586,028	\$2,709,198	\$13,244,616
Manufacturing	\$424,522,477	\$22,931,130	\$3,514,500	\$450,968,107
Wholesale Trade	\$0	\$59,489,894	\$13,024,968	\$72,514,862
Retail Trade	\$0	\$705,873	\$34,385,992	\$35,091,865
Transportation & Warehousing	\$0	\$11,829,295	\$6,092,106	\$17,921,401
Information	\$39,901,539	\$22,320,103	\$6,798,574	\$69,020,216
Finance & Insurance	\$0	\$10,764,989	\$30,385,548	\$41,150,537
Real Estate	\$0	\$6,660,826	\$8,062,501	\$14,723,327
Professional Scientific & Technical Services	\$9,526,526	\$125,547,769	\$17,235,094	\$152,309,389
Management of Companies	\$0	\$77,312,454	\$2,171,673	\$79,484,127
Administrative & Waste Services	\$1,321,825	\$27,581,929	\$9,788,178	\$38,691,932
Educational Services	\$0	\$126,128	\$10,544,029	\$10,670,157
Health & Social Services	\$319,230	\$12,356	\$72,773,609	\$73,105,195
Arts, Entertainment & Recreation	\$0	\$1,425,654	\$3,760,307	\$5,185,961
Accommodation & Food Services	\$0	\$2,510,092	\$13,137,423	\$15,647,515
Other Services	\$0	\$8,718,137	\$21,221,167	\$29,939,304
Government	\$0	\$3,890,401	\$6,107,376	\$9,997,777

Source: JFI and IMPLAN

Some Measures of the Return on Investment on the State of Maryland's Investment in the MIPS Program

It was outside of the scope of this analysis to conduct a full analysis of the State of Maryland's return on investment in the MIPS program. There is insufficient data available on the annual economic impacts associated with the program to prepare this type of return on investment estimate. However, the Jacob France Institute prepared some simple measures of the leveraging impact of the MIPS program, in terms of the job and tax benefits associated with the commercialization of MIPS supported technologies.⁸ Selected measures of the leveraging impacts of the MIPS program are presented in Table 10.

As described above, the 2011 economic impacts associated with MIPS supported technology generated an estimated \$87.3 million in estimated state revenues in the year 2011 alone.⁹ The estimated 2011 state tax revenues associated with the production and sale of MIPS supported technology generates more than the \$37 million lifetime costs of the program. After adjusting for inflation, the lifetime costs of the MIPS program in 2011 dollars is \$46.2 million. When 2011 state government revenues are compared to the lifetime costs of the program, 2011 revenues *alone* are almost two times (1.89) the *lifetime* costs of the program.

Table 10
Measures of the Leveraging Impacts of the MIPS Program

Item			
Twenty Five Year Cost of the Program (Current \$s)		\$37,000,763	
Twenty Five Year Cost of the Program (2011 \$s)		\$46,194,433	
<u>Selected Leveraging Measures</u>			
Estimated 2011 State Government Revenues - Commercialized Technologies		\$87,253,338	
2011 State Gov't Revenues/Lifetime Program Costs (2011 \$s)		\$1.89	
Jobs Created Associated with Commercialized Technologies		3,615	Per \$ of
Cost per Job Created (Current \$s)		\$10,236	Lifetime Cost
Cost per Job Created (2011\$)		\$12,780	(Current \$s)
EIS Reported Commercialization Related Grants/Contracts		\$138,943,794	\$3.76
EIS Reported Commercialization Related Equity, Debt, Venture Capital		<u>\$745,247,500</u>	\$20.14
	Total	\$884,191,294	\$23.90

Source: MIPS and JFI

⁸ As described in Note 6 above, this analysis is based on the reported economic impacts associated with the development, commercialization, production and sale of MIPS supported technologies and did not ascertain the extent to which the MIPS provided assistance led to or caused this outcome.

⁹ The IMPLAN model used estimates combined state and local government revenues. State revenues were estimated based on U.S. Bureau of the Census data on the share of state and local revenues from each IMPLAN estimated revenue source.

It is clear that by supporting the commercialization of new advanced technologies that have been produced and created jobs in Maryland, the MIPS program has contributed to Maryland economic development success. If the \$37.0 million in total MIPS program spending is divided by the estimated 3,615 ongoing jobs supported by MIPS technology, the total state cost per job created is only \$10,236, a very low level of cost per job creation. Even this low cost per direct job created is only part of the story of the economic and commercialization impacts of the MIPS program. According to the MIPS economic impact data collected, the reporting companies have also attracted an additional \$138.9 million in federal and other grants to further develop the MIPS supported technologies commercialized and these companies reported \$745.3 million in debt, equity, and venture capital funding to further develop and commercialize MIPS supported technologies. Thus, the \$37.0 million in State of Maryland MIPS spending assisted in catalyzing the development and commercialization of technologies that have attracted \$884.2 million in additional grant, debt, equity, and venture capital funding into Maryland, an amount almost 24 times the cost of the program. Several MIPS supported companies have also been acquired over the past several years and the acquisition cost of these companies has totaled over \$18.0 billion dollars. *While it is impossible to ascertain the exact extent to which the MIPS program fully contributed to the actual commercialization of each technology, it is never-the-less clear that the MIPS program has supported the development and commercialization of new products and technologies that have made a significant contribution to the Maryland economy.*

Economic Impact Methodology

The JFI analyzed the economic impact of both the 2011 MIPS Research Funding as well as self-reported data on the economic impacts associated with the commercialization of MIPS funded technologies by the companies participating in the program. The Jacob France Institute analysis of the economic impacts associated with MIPS research and the commercialization of MIPS-supported technologies makes use of a custom economic input/output (I/O) model quantifying the interrelationships between economic sectors in the State of Maryland. I/O data show the flow of commodities to industries from producers and institutional consumers for any given state, region or county. The data also show consumption activities by workers, owners of capital, and imports from outside the state or region. These trade flows built into the model permit estimating the impacts of one sector on all other sectors with which it interacts. These impacts consist of three types:

Direct Impacts are, in this case, the specific impact of the research spending of the MIPS program in 2011 and the employment and revenues associated with the commercialization, production, and sale of MIPS-supported technologies;

Indirect Impacts are the impact of purchases from local in-State suppliers related to MIPS research and the commercialization, production, and sale of MIPS-supported technologies; and

Induced Impacts are the additional economic impact associated with the spending of the employees filling the jobs supported or created by MIPS research and the commercialization of MIPS-supported technologies.

In other words, I/O analysis models the flow of funds that originate from the direct expenditures associated with both MIPS research and with the commercialization, production, and sale of MIPS-supported technologies in the Maryland economy and the ongoing ripple

(multiplier) effect of these expenditures. I/O analysis represents the “gold standard” for measurement of economic impacts and is the generally accepted methodology for measuring the economic impact associated with projects, companies, or of entire industries.

The economic impacts associated with MIPS research and the commercialization, production and sale of MIPS-supported technologies were calculated using a Maryland specific I/O model purchased from the IMPLAN Group (one of three major developers of regionally specific I/O tables). IMPLAN provides a specialized software system for impact analysis and highly detailed data tables at the national, state, and county levels with the ability to combine county data into models that represent a specific geographic area such as a multicounty service region or an MSA. The Jacob France Institute acquired the necessary data files for use with the IMPLAN system and developed a model for the State of Maryland. The IMPLAN model uses detailed sector- and region-specific information to estimate outcomes and gauge potential impacts. The model incorporates detail on more than 420 individual industry sectors that cover the entire state economy. The IMPLAN model allows for the estimation of three key economic impact measures used in this analysis:

- Employment*** – The total number of full and part time jobs in all industries;
- Labor Income*** – All forms of employment income, including employee compensation (wages and benefits) and self employment earnings; and
- Output*** – The total value of production or sales in all industries.