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EVALUATION AND ECONOMIC IMPACT OF THE MONTANA MANUFACTURING EXTENSION CENTER

EXECUTIVE SUMMARY

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Executive Summary

The Montana Manufacturing Extension Center (MMEC) works with manufacturers to create and retain jobs, innovate, reduce costs, increase profits and save time and money. MMEC employees typically make on-site visits to manufacturing clients to assess problems, suggest appropriate solutions and assist with implementation.

MMEC closely monitors its performance by welcoming feedback and carefully following an evaluation procedure developed by the National Institute of Standards and Technology (NIST).

Clients are surveyed six months after a project is complete and asked about their satisfaction with the services they received. These respondents are also asked to quantify certain economic impacts and outcomes associated with the MMEC project. This report summarizes the surveys completed in 2018.

NIST has developed a standardized questionnaire and specifies when manufacturing clients are to be interviewed. This is the 10th year that this evaluation procedure has been used to gather the data. Responses may be compared for the entire 2009-18 period. The survey findings are as follows:

- Montana manufacturing clients were very satisfied and would be very likely to recommend MMEC to other firms.
- About 57 percent of the respondents said they relied exclusively on MMEC as a business service provider. This is down slightly from 2017, yet remains in the top three highest figures since 2010. This indicates sustained confidence in MMEC. This percentage declined from 2009 to 2013, but reversed in 2014 and remained stable for three years. In 2017, it increased to 61 percent and most recently decreased slightly.
- The professionalism and knowledge of the MMEC staff continues to be the major strength of the center and several of the evaluations enthusiastically mentioned specific staff members.
- The 2018 Net Promoter Score (NPS), a quantitative measure of satisfaction, was calculated to be 84. The NPS has been 84 in five out of the 10 recorded years of the survey – the most recent being 2017. This is down slightly from the 2016 value of 86, which was the second highest NPS since calculations began in 2009.
- The most important challenges facing surveyed MMEC clients were ongoing continuous improvement/cost reduction strategies, employee recruitment and retention, and product innovation/development. The least mentioned were financing and exporting/global engagement.
- The perceived challenges mentioned by MMEC clients have changed over the nine years this survey has been conducted, perhaps reflecting the different phases of the business cycle. Cost reductions, product innovation and identifying growth opportunities ranked high during the entire 2009 to 2018 period. Personnel issues (employee recruitment and retention) have risen as the labor market tightens. Fewer respondents mentioned financing as a challenge as the economic recovery has strengthened.
- The most often reported outcome mentioned in 2018 was increased investments in plant or equipment. Second was workforce/employee skills. Cost savings ranked high during each of the nine years analyzed, but the highest rankings occurred just as the Great Recession was ending during 2009-13.
- Quantitative estimates of the outcomes of MMEC visits are volatile from one year to the next. The only consistent pattern was that they all increased significantly after recession lows in 2009. Thereafter, sizable increases and decreases alternated from one year to the next within each outcome category with no discernible pattern.
- The 2018 survey respondents said that MMEC visits resulted in 421 new and retained manufacturing jobs and directly or indirectly added approximately $2,419,959 to Montana individual income tax revenue.
- The Montana return on investment for MMEC during 2018 was about 7.9 to 1. The state received about $7.93 in income tax revenue for each dollar invested in MMEC.

- MMEC clients paid approximately $904,642 in fees during 2018. Their return on investment in 2018 was approximately 9.8 to 1.

The Evaluation Process

The MMEC evaluation process follows guidelines developed by NIST as part of its management information reporting procedures. NIST specifies the timing of the evaluation and provides a standardized questionnaire distributed to manufacturing firms served by MMEC. The analysis of the surveys and a written report are provided by an independent analyst.

Manufacturing clients are asked to evaluate the effectiveness of MMEC and to quantify the economic impact of MMEC's activities on their business and its effects on the Montana economy. MMEC sent the independent analyst preparing this report 59 questionnaires for the 2018 evaluation period. After careful review, one was judged to be incomplete or otherwise unusable because none of the questions were answered. Consequently, there were 58 questionnaires in the 2018 evaluation. These questionnaires provided the largest sample size since the evaluations began and are well above the range of 41 to 47 completed questionnaires from 2009 to 2015, and 52 completed questionnaires in 2016 and 2017.

This is the 10th year that the evaluation process utilized the same questionnaire and timing. Earlier data from 2009 to 2017 evaluations are presented in many of the following tables. This allows identification and analysis of trends in the evaluation metrics.

Overall Satisfaction

Manufacturing clients said they relied heavily on MMEC and were very satisfied with the services received. In 2018, about 57 percent of the respondents said they relied exclusively on MMEC and did not consult with any other provider of business performance services.

Between 2009 and 2013, more respondents said they were using additional providers. As reported in Table 1, the percentage of respondents who said they relied only on MMEC dropped from 68 percent to 37 percent from 2009 to 2013. The 2014 to 2017 values were in the 54-61 percent range ending the downward trend. In 2018, about 57 percent of the respondents said they relied only on MMEC and not on other external providers. This is down slightly from the peak in 2017 of 61 percent, but still above the average since 2009.

Montana manufacturers were asked if they would recommend MMEC to other potential clients. They were asked to rate the likelihood of a positive recommendation with one being the least likely and 10 being the most likely. As shown in Table 2 about 74 percent of the 2018 respondents chose 10, approximately 12 percent chose nine and 10 percent chose eight. About 4 percent of the respondents chose a value of seven or less.

The Net Promoter Score (NPS) is calculated by subtracting the percentage of respondents choosing one to six from the percentage choosing nine and 10. MMEC's 2018 NPS is 84 (86 percent minus 2 percent equals 84). The NPS values for 2009 to 2018 are presented in Table 3. From 2009 to 2013 there was an upward trend in the NPS. The value fell sharply to 79 in 2014 and then turned upward and stabilized in the 82 to 86 range from 2015 to 2018. As shown earlier in Table 2, the decline in 2014 may be traced to the 10 percent drop in respondents giving MMEC a 10 rating – perhaps due to the closing of the Billings office. The percentage of respondents awarding a 10 in 2015 jumped to 83 percent, an all-time high. The percentage of respondents giving a 10 in 2016-18 dropped to the 72 to 75 percent range, but 11 to 16 percent selected the second highest rating of nine. Overall, the return of the NPS to the mid-80s range in 2015 to 2018 suggests that the MMEC has overcome the decline in measured satisfaction in 2014.

Table 1. *Have you used any external providers for business performance services?*

Year	Yes	No	No response
2009	32%	68%	-
2010	36%	62%	2%
2011	42%	58%	-
2012	52%	48%	-
2013	63%	37%	-
2014	46%	54%	-
2015	44%	56%	-
2016	46%	54%	-
2017	39%	61%	-
2018	43%	57%	-

Table 2. *How likely would you be to recommend MMEC to other clients?*

	Not likely									*Very likely*
Year	1	2	3	4	5	6	7	8	9	10
2009	-	3%	-	-	3%	-	-	10%	18%	66%
2010	-	-	-	-	2%	2%	4%	4%	17%	71%
2011	-	-	-	-	-	-	2%	14%	12%	72%
2012	-	-	-	-	2%	-	5%	7%	10%	76%
2013	-	-	-	-	-	-	4%	4%	9%	82%
2014	-	-	-	-	5%	-	2%	9%	11%	73%
2015	-	-	-	-	3%	-	2%	10%	2%	83%
2016	-	-	-	-	-	2%	2%	8%	16%	72%
2017	-	-	2%	-	-	-	6%	6%	11%	75%
2018	-	-	2%	-	-	-	2%	10%	12%	74%

Table 3. *Net Promoter Score (NPA) 2009 to 2018.*

Year	NPS
2009	78
2010	84
2011	84
2012	84
2013	91
2014	79
2015	82
2016	86
2017	84
2018	84

Note: Net Promoter Score is calculated by subtracting the percentage of respondents choosing one to six from the percentage choosing nine and ten as reported in Table 2.

Why MMEC Was Chosen

The NIST questionnaire provided eight reasons for choosing MMEC and the respondents were asked to identify the two most important. These responses are reported in Table 4, in descending order of 2018 responses. About 72 percent of the respondents mentioned staff expertise of MMEC as the most important reason.

The second most important factor for firms choosing MMEC was the MMEC's reputation for results. About 31 percent of the respondents mentioned this factor, which is the highest percentage in this category since 2014 and up significantly from 19 percent in 2017.

Twenty-nine percent of respondents mentioned knowledge of the respondent's industry, placing it third. This is the highest response rate in this factor since the beginning of the survey in 2009. About 24 percent of the respondents mentioned MMEC's cost of services as the reason they choose them, leading to the fourth ranked factor. As in all previous years, the two least mentioned factors were specific services not otherwise available and the lack of other providers nearby.

The 2017 responses are quite similar to those from earlier years. The rank orderings of the reasons for choosing MMEC have remained relatively constant with only a minor switching of second through fifth places. Staff expertise has been solidly in first place all ten years.

Table 4. *Important factors for your firm choosing MMEC.*

	Percent mentioning									
Factor	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Staff expertise	55%	81%	62%	71%	80%	80%	85%	69%	87%	72%
Reputation for results	29%	26%	33%	33%	24%	33%	29%	29%	19%	31%
Knowledge of your industry	16%	11%	18%	26%	26%	22%	24%	17%	23%	29%
Cost/price of services	32%	28%	29%	26%	33%	22%	17%	29%	15%	24%
Fair and unbiased advice/services	34%	19%	22%	19%	22%	24%	20%	29%	21%	17%
Specific services not otherwise available	16%	6%	7%	12%	4%	7%	10%	10%	15%	14%
Lack of other providers nearby	7%	9%	7%	2%	9%	4%	7%	8%	10%	3%

Client Comments

The NIST questionnaire provides a number of opportunities for Montana manufacturers to provide suggestions and comments to MMEC. These responses were edited slightly to preserve anonymity and grouped by topic. They are presented in Table 5. These comments provide insight into the many ways manufacturers are benefitted by MMEC services. The vast majority of the comments are highly positive and detailed and, as in the past, respondents made several specific suggestions concerning ways in which MMEC may further tailor its services in the future.

Table 5. Comments from respondents.

Professionalism and relevance
Appreciate all of the guidance that we have gotten from MMEC.
Love the hands-on stuff and when companies host events. Great to have a pool to pull from in the local community.
The TDMI project conducted with MMEC helped us obtain two grants aiding in the development of our field mapping software. Combined these grants totalled $130,000. We are looking at a Phase II of this grant process with at total upwards of $680,000 if obtained. This would not have been possible without the help from MMEC.
The benefits of the application in LEAN learned via MMEC has been dramatic. We've 5S'd two areas in our Montana facility, started on a third and our complete production facility in Tennessee. We've increased productivity in our major process by five and decreased energy usage by 20K/yr without any investment. We cut wasted work time by three workdays per month with just a $2,000 one-time investment. We reduced finished goods inventory by 30 and recovered valuable floor space without any investment. We close our books at the end of the month two days sooner without any investment. These all contribute to safety worker retention moral and competitiveness. These improvements don't all fit into the measurable categories in this survey but they contribute everyday in making us globally competitive. If I have a regret it is that we aren't dedicating more resources to the skills MMEC provided to us. MMEC/NIST could look to ask a broader range of questions that indicate its influence to the bottom line of a client. We are considering bringing MMEC in for another round of training to all employees in our facility because employee engagement is the smartest investment in this competitive global environment.
Very knowledgeable about manufacturing and how processes/procedures can benefit a company. Our company can benefit greatly from using MMEC, timing to implement has been our challenge. Have enjoyed working with the center.

Suggestions for MMEC
Continue with offerings and consulting services. Excellent resource for our community.
ERP Solutions Automation Resources.
I enjoy and appreciate the collaboration with other organizations in and around the area. Much of which would not be in place without MMEC and the efforts they have put in to it. I would like to see additional venues and opportunities to continue collaborating efforts, which makes our area stronger and attracts the talent we all need.
Increase awareness of MMEC beyond events and business visits. Additional marketing is recommended.
Keep up the good work – MMEC is an amazing organization. New businesses are often the ones who really need your services the most, but maybe can't afford you. The services and expertise provided are pricey by their nature, but that's just the reality of business – it's hard for start-ups and early stage businesses to afford.
Keep up the great work. Investigate the need for sustainability metrics program development and reporting
MMEC is a great resource to provide to local manufacturers in a small community. The scope for our event may have been too broad reducing the scope to focus on specific areas could provide helpful.
More awareness of MMEC.

More information on the services available would be great. I think there are a lot of businesses in Montana that aren't aware of your services.
More lunch learn seminars and specific manufacturing, i.e. digital manufacturing, etc. and quality improvement/communication techniques.
Please continue to offer your awesome and invaluable engineering expertise along with assistance with training and education for employees of manufacturers at all levels. Communication skills management and coaching skills, leadership skills, Lean 'Thinking' Efficiency Teamwork. Change management and being open to change are also necessary attributes to survive in today's business environment.
The cancellation of the additional contract was not taken into consideration with these rankings. We (myself and project investors – yes we had financial investors following the projects progress) were blindsided by having been led to believe that we could immediately machine after the CAD work instead of having to have new tools developed to then machine. The lack of machining tools in our opinions should have been foreseeable and not manifested part way through the contract.
We would love to have the opportunity to network with other manufactures with the goal of building relationships best practices and opportunities. Maybe this is something MMEC could facilitate? We are currently working with the center on inventory management cash flow management sourcing assistance and supply chain management strategies.

Other comments
Fantastic organization!
Great resource.
Great customer service.
In state of Montana, there are basically no private manufacturing consultants available. Succession planning is going to become more critical as small businesses need to migrate to new ownership or closed their doors. The “don't know” answers are a reflection of lack of software to validate the answers.
Keep up the good work! Thank you for everything that you guys have done for us.
Service was outstanding.
Thanks for all your assistance!!!
The survey is complicated. The 12-minute guidance is nowhere accurate. The value of MMEC to our company cannot come close to being attained anywhere else.

Future Challenges

The NIST questionnaire provided two opportunities for the respondents to identify future challenges they may face. The first opportunity instructed the respondents to pick three of nine categories of potential future challenges and the second was an open-ended question.

As shown in Table 6 (in descending order of 2018 responses), the most often mentioned future challenges were ongoing continuous improvement/cost reduction strategies (72 percent). Employee recruitment and retention was second (53 percent) and product innovation/development was third (40 percent). The least mentioned were exporting/global engagement (7 percent) and financing (12 percent).

Since the beginning of the survey, the most important reported challenges have stayed relatively stable, with continuous improvement/cost reduction strategies consistently ranked among the top two challenges. Again in 2018, we see that this remains the top priority. Several other challenges have risen or declined in importance over the business cycle. Personnel issues (employee recruitment and retention) has consistently climbed since 2009 and ranked #2 in 2018, giving further evidence of a tightening labor market. Similarly, there were again fewer respondents who mentioned financing as a future challenge, with the percent mentioning this challenge matching its record low of 12 percent. Lastly, exporting/global engagement was given its lowest importance since 2009, with only 7 percent mentioning this challenge.

The NIST questionnaire also provided an open-ended question that allowed each respondent to identify challenges not on the list. Eight open-ended responses were given in 2018, they were: “ownership transition,” “raw material supply,” “facility footprint availability,” “plant startup,” “project completion for retail sales,” logistics/transportation,” succession planning,” and “training development program.”

Table 6. Important future challenges facing your business.

	Percent mentioning									
Challenge	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Ongoing continuous improvement/cost reduction strategies	61%	66%	51%	69%	54%	67%	63%	65%	57%	72%
Employee recruitment and retention	29%	30%	20%	33%	41%	38%	46%	40%	44%	53%
Product innovation/development	53%	51%	49%	59%	59%	40%	56%	56%	48%	40%
Identifying growth opportunities	42%	47%	40%	64%	52%	53%	41%	60%	50%	36%
Managing partners and suppliers	11%	15%	25%	10%	17%	11%	24%	14%	23%	19%
Sustainability in products and processes	18%	13%	24%	14%	15%	16%	22%	8%	17%	19%
Technology needs	16%	8%	4%	10%	15%	20%	7%	19%	13%	17%
Financing	26%	23%	16%	12%	15%	18%	12%	14%	14%	12%
Exporting/global engagement	17%	19%	9%	12%	9%	13%	10%	8%	10%	7%

Outcomes of MMEC Visits and Services

Ten potential outcomes of MMEC visits were listed on the NIST questionnaire and Montana manufacturers were asked which were experienced by their firm. The tabulations of outcomes are presented in Table 7 in descending order of 2018 responses.

The most reported outcome was an increased investment in plant/equipment (55 percent). Second place was investment in workforce practices or employee skills (53 percent), while third was cost savings (at 50 percent). At the lower end, increased investment in information systems or software and avoiding unnecessary investments were each mentioned by 31 percent of the respondents.

The outcomes of MMEC visits have changed in relative importance over the years. Table 8 shows a tally of the years in which each category ranked in the top four. In eight of the last 10 years, investment in workforce practices or employee skills has ranked in the top two outcomes. And in six of the last 10 years, investments in plant or equipment has ranked in the top two. The 2018 responses are in line with this pattern, with those two outcomes again claiming the top two rankings.

Table 7. *Outcomes of MMEC visits and services.*

	Percent mentioning									
Outcome	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Invest in plant or equipment	53%	57%	57%	60%	58%	44%	53%	50%	54%	55%
Invest in workforce practices or employee skills	50%	66%	67%	65%	63%	42%	59%	48%	62%	53%
Cost savings	68%	70%	64%	57%	70%	42%	51%	48%	54%	50%
Create jobs	34%	51%	52%	42%	58%	42%	41%	38%	44%	47%
Retain jobs	50%	53%	60%	55%	63%	56%	53%	44%	39%	45%
Retain sales	40%	51%	38%	40%	53%	44%	39%	38%	40%	43%
Invest in other areas of business	34%	45%	48%	43%	42%	24%	46%	44%	31%	41%
Increase sales	42%	47%	48%	60%	60%	38%	41%	27%	40%	36%
Avoid unnecessary or save on investments	29%	51%	48%	40%	39%	24%	28%	35%	37%	31%
Invest in information systems or software	42%	28%	36%	29%	43%	38%	39%	27%	27%	31%

Table 8. Top outcome categories of MMEC visits and services.

Category	Rank #1	Rank #2	Rank #3	Rank #4
Workforce investment	2011, 2012, 2015, 2017	2010, 2013, 2016, 2018	2009	-
Retain jobs	2014	2015	2011, 2013	2009, 2010, 2016
Plant/equipment investment	2016, 2018	2009, 2012, 2014, 2017	2010, 2015	2011
Cost savings	2009, 2010, 2013	2011	2016, 2017, 2018	2012, 2015, 2014
New jobs	-	-	-	2017, 2018
Increase sales	-	-	2012	2013
Retain sales	-	-	2014	-
Info systems investment	-	-	-	-
Avoided investments	-	-	-	-
Other Investment	-	-	-	-

Quantitative Estimates of MMEC Visit Outcomes

The NIST survey asked Montana manufacturers to quantify certain outcomes of the MMEC visit. They were asked the number of new and retained jobs, the amounts of cost savings, new and retained sales, capital and workforce investments and avoided unnecessary investments. Starting in 2009, the respondents were queried further about four detailed investment categories.

As reported in Table 9, the 2018 respondents said that there were 421 new or retained jobs as a result of the MMEC visit. New and retained sales were about $72 million. Cost savings totaled approximately $7 million and capital and workforce investments were roughly $53 million. Avoided unnecessary investment totaled about $1.7 million.

There are 10 years of data collected in a consistent manner in Table 9, which could potentially reveal trends and/or cyclic patterns. Unfortunately, extreme year-to-year volatility in the reported outcomes mask trends and other patterns. For example, the number of new and retained jobs dropped from 880 in 2011 to 440 in 2012, then rebounded to 660 in 2013.

An examination of the responses revealed a number of cases where the value of the estimated outcomes was dominated by a few (mostly one, but at most two very large) responses. These few responses can skew time series analysis and obscure long-run trends. Typically, large responses accounted for one-third to one-half the reported total. Consequently, there are two entries for each category starting with 2010. The first includes all responses as reported and the second excludes the distorting entries.

Unfortunately, the edited values are almost as volatile as the unedited. For example, the edited figures for new and retained jobs still bounce from 168 in 2014 to 280 in 2016, then to 297 in 2017. Moreover, there is no correlation between the quantitative outcome categories. For example, the edited value for new and retained jobs was 280 in 2016, the second highest reported. At the same time the edited 2016 value for new and retained sales was only $11.5 million, the lowest reported during the entire 2009 to 2016 period.

All of the outcome categories had one characteristic; sizable increases from recession lows and then stabilization within a range. For example, the value for new and retained sales was $8.9 million in the recession year 2009, but the edited values never dropped below $11 million in the following years and stood at $40.4 million in 2018.

The lower portion of Table 9 presents detailed data for subcategories of capital and workforce investments. The edited and unedited values for these four detailed categories display the same volatility as the major categories in the upper portion of the table. But all show significant increases from the recession lows in 2009.

The 2010-18 ranges for edited values of the quantitative outcomes in each category are as follows:

Category	Range
New and retained jobs	160-346
New and retained sales	$11-$40 million
Cost savings	$1.3-$6.6 million
Capital and workforce investments	$1.2-$19 million
Investment in plant/equipment	$800,000-$14.2 million
Investment in information systems or software	$190,000-$750,000
Investment in workforce practices or employee skills	$175,000 -$1.3million
Other investments	$2.9-$8.6 million
Avoided unnecessary investments	$150,000-$1.9 million

Table 9. Quantitative estimates of MMEC visit outcomes

	2008	2009	2010	
Economic Impact	-	-	As reported	Edited
New and retained jobs	142	113	355	221
New and retained sales	$23,460,000	$8,870,000	$170,562,000	$30,562,000
Cost savings	$2,240,000	$2,200,000	$13,462,900	$3,462,900
Capital and workforce investments	$6,410,000	$3,494,740	$29,489,900	$12,214,940
Investment in plant/equipment	-	$1,849,000	$7,940,200	$7,690,200
Investment in information systems or software	-	$297,140	$226,600	$226,600
Investment in workforce practices or employee skills	-	$320,600	$718,700	$693,700
Other investments	-	$1,028,000	$20,604,400	$3,604,440
Avoided unnecessary investments	-	$296,100	$3,862,300	$1,862,300

	2011		2012		2013	
Economic Impact	As reported	Edited	As reported	Edited	As reported	Edited
New and retained jobs	890	285	440	160	660	248
New and retained sales	$231,940,000	$31,939,800	$200,262,916	$25,262,916	$135,930,900	$25,930,900
Cost savings	$21,809,100	$1,326,300	$7,669,722	$1,921,722	$3,799,329	$3,158,287
Capital and workforce investments	$20,347,000	$18,694,000	$30,304,549	$10,560,197	$34,851,915	$8,792,830
Investment in plant/equipment	$15,800,400	$14,200,400	$13,011,450	$6,811,450	$2,719,400	$2,709,400
Investment in information systems or software	$583,300	$583,300	$191,200	$191,200	$744,150	$744,150

Investment in workforce practices or employee skills	$459,600	$406,600	$789,311	$676,579	$623,200	$470,115
Other investments	$3,503,700	$3,503,700	$16,312,588	$2,880,968	$30,765,165	$4,869,165
Avoided unnecessary investments	$2,564,700	$514,700	$1,542,590	$1,542,590	$1,154,000	$154,000

	2014		2015		2016	
Economic Impact	As reported	Edited	As reported	Edited	As reported	Edited
New and retained jobs	453	168	388	230	405	280
New and retained sales	$73,404,315	$37,404,315	$71,911,172	$27,122,000	$64,700,000	$11,508,063
Cost savings	$2,467,816	$1,967,816	$4,996,245	$3,472,245	$4,600,963	$4,600,963
Capital and workforce investments	$7,033,288	$5,913,288	$21,373,905	$11,771,165	$18,924,380	$15,096,380
Investment in plant/equipment	$858,800	$838,800	$4,448,000	$4,448,000	$4,930,500	$4,930,500
Investment in information systems or software	$349,000	$349,000	$304,000	$214,000	$498,850	$488,850
Investment in workforce practices or employee skills	$277,428	$177,428	$381,156	$349,316	$1,112,000	$1,073,000
Other investments	$5,548,060	$4,548,060	$16,240,749	$6,759,849	$12,383,030	$8,604,030
Avoided unnecessary investments	$1,252,958	$1,252,958	$796,000	$796,000	$1,276,000	$1,276,000

	2017		2018		Total Six Years (2013-2018)	Since MMEC Inception (1996)
Economic Impact	As reported	Edited	As reported	Edited		
New and retained jobs	397	297	421	346	2,724	3,164
New and retained sales	$63,024,501	$33,824,501	$71,839,173	$40,389,173	$480,810,061	$1,290,344,977
Cost savings	$20,817,817	$6,558,817	$7,188,002	$3,888,002	$43,870,172	$115,181,894
Capital and workforce investments	$23,233,163	$17,233,163	$53,011,863	$18,126,863	$158,428,514	$282,949,963
Investment in new products	-	-	$18,516,395	$3,516,395	$3,516,395	$3,516,395
Investment in plant/equipment	$12,960,300	$6,960,300	$21,167,930	$6,167,930	$47,084,930	$34,128,230
Investment in information systems or software	$695,120	$695,120	$1,247,405	$622,405	$3,838,525	$1,942,525
Investment in workforce practices or employee skills	$1,266,149	$1,266,149	$610,504	$350,504	$4,270,437	$1,876,653
Other investments	$8,311,594	$8,311,594	$11,469,629	$7,469,629	$84,718,227	$19,781,223
Avoided unnecessary investments	$793,800	$793,800	$1,698,828	$978,828	$6,971,586	$2,492,628

Economic Impacts of MMEC Visits and Services

MMEC clients were queried about the number of new jobs created and the number of jobs retained as a result of the visit. The 2018 respondents said that there were 168 new jobs created and 253 jobs retained for a total of 421 jobs.

The preliminary data suggest that average wages for Montana manufacturing jobs were about $52,832 in 2018. Total wages associated with the new and retained jobs were approximately $22,242,272 (421 X $52,832 = $22,242,272). Using an average tax rate of 4 percent, the new and retained workers paid approximately $889,691 ($22,242,272 X .04 = $889,691) in Montana individual income taxes.

The Montana Department of Labor and Industry estimates that the employment multiplier of manufacturing is 3.58. This suggests that about 2.58 new jobs will be created in other sectors as a result of one new manufacturing job. This agency also reports that the wage multiplier is 2.72, implying that an additional $1.72 in wages is created elsewhere in the Montana economy for each $1 in new manufacturing wages.

Calculations based on employment and wage multipliers are reported in Table 10. The 421 new and retained jobs associated with MMEC visits reported in 2018 led to a total of 1,507 (421 X 3.58 =1,507.2) new jobs in Montana and approximately $60,498,980 ($22,242,272 X 2.72 = $60,498,980) in statewide wages. The additional wages generated roughly $2,419,959 ($60,498,980 X .04 = $2,419,959) in Montana individual income tax revenue.

Table 10. *Economic impacts of MMEC services, 2018.*

Sector	Jobs	Wages	Montana individual income taxes
Manufacturing	421	$22,242,272	$889,691
Other industries	1,086	$38,256,708	$1,530,268
Total	1,507	$60,498,980	$2,419,959

Return on Investment and Fees

MMEC is a public-private partnership that is awarded $512,000 annually from the National Institute of Standards and Technology with a match requirement. In 2018, MMEC matched the federal funds with $305,000 from the state of Montana and $904,642 in project fees that were charged to Montana manufactures who requested MMEC services. The benefits of these investments may be estimated by calculating a return on investment (ROI) for each. The ROI for the state of Montana is calculated by comparing the estimated increase in Montana individual income tax payments associated with the reported jobs created or saved due to a MMEC visit. The ROI for MMEC clients is estimated by comparing the cost savings, plus avoided unnecessary investment, plus a portion of the increase sales to the amount paid by clients.

As shown in Table 10, MMEC projects generated approximately $2,419,959 in Montana individual income taxes from both direct and indirect jobs. Based on $305,000 calendar year funding for MMEC, Montana's return on investment during 2018 was approximately 7.9 to 1 ($2,419,959 ÷ $305,000 = 7.93). Therefore, the public dollars invested in MMEC provide Montanans an excellent rate of return.

As presented in Table 9, MMEC clients reported $3,888,002 in costs savings, $978,828 in avoided unnecessary investments and $40,389,173 in new or retained sales. Assuming a modest 10 percent gross margin, the net gain to clients of the new or retained sales was $4,038,917 (0.1 X $40,389,173 = $4,038,917). Cost savings + avoided investments + gross margin associated with new and retained sales equals $8,905,747 ($3,888,002 + $978,828 + $4,038,917 = $8,905,747). Based on the $904,642 in fees paid by MMEC clients, their return on investment in 2018 was approximately 9.8 to 1 ($8,905,747÷ $904,642 = 9.84). Therefore, the fees paid by MMEC clients provide them an excellent return.