COMPREHENSIVE IMPACT REPORT

# MARYLAND INDUSTRY 4.0 TECHNOLOGY GRANT PROGRAM

Maryland
DEPARTMENT OF COMMERCE

FY2023, 2024, and 2025

# Executive Summary

In response to the rapidly evolving landscape of advanced manufacturing, Maryland established the Manufacturing 4.0 (M4) Grant Program to modernize its industrial base and foster innovation for the “fourth industrial revolution.” The fourth industrial revolution refers to the ongoing transformation of industries driven by advanced technologies such as artificial intelligence (AI), robotics, the Internet of Things, biotechnology, and quantum technology. The transformation is reshaping economies and workforces at an unprecedented pace, offering opportunities for innovation and growth. TThe grant program  grew out of the recommendations of the Transforming Manufacturing in a Digital Economy Workgroup, which promoted a proactive, strategic approach by the state to support small and mid-sized manufacturers in adopting Industry 4.0 technologies. Enacted in 2023, the enabling legislation created the Industry 4.0 Technology Grant Program at the Maryland Department of Commerce, with a mandated annual appropriation of $1,000,000 through FY28 and awards range from a minimum grant award of $25,000 to a maximum of $500,000. The average awards were $42,887, $38,462, and $116,279, for FY23, FY24, and FY25, respectively. Grants are competitively awarded based on applicants’ alignment with Industry 4.0 transformation goals and the projected impact on productivity and competitiveness.

Over its first three years, the M4 program has produced significant and measurable outcomes across key impact areas. It has granted $6,986,400 to 91 Maryland manufacturers, contributing to nearly $17,000,000 in advanced manufacturing modernization projects. The FY25 (M425) cycle alone distributed $5,000,000 to 43 manufacturers. The program has led to substantial increases in throughput, with nearly 80% of grantees reporting at least an 11% increase in production. Small manufacturers (with between three and 49 FTEs) have been a large beneficiary of the program, receiving 71.4% of the funding between FY23 and FY25. The program also catalyzed company investment well beyond the required match. In many cases, the grant served as a gateway to continued modernization efforts, with companies making further capital investments in robotics, automation, and high-precision equipment that enhance both efficiency and capacity.

Stakeholder outcomes further underscore the program's success. For manufacturers, this translates to increased revenue, market share, operational efficiency, and competitiveness. Employees benefit from job security, skill development, and improved work environments. Nearly 70% of grantees reported upskilling their employees, and more than 25% added new hires, proving that automation and job growth can coexist. For the State of Maryland, the program ensures economic resilience by retaining jobs and manufacturing within the state, while simultaneously offering a strong return on investment (ROI). AI usage, while not a grant requirement, was tracked as a metric to analyze 4.0 technology adoption. A key area for future focus remains addressing broader "manpower issues" through deeper workforce development partnerships to complement technological advancements.

Looking ahead, the program’s continued success depends on expanding its scope and funding. Increased state investment is also critical to improving Maryland’s overall business

climate, which currently ranks 32nd in the nation, and to ensuring the state remains an attractive hub for advanced manufacturing companies. It is especially important given that competing Eastern Seaboard states like Massachusetts and New Jersey are investing tens of millions of dollars, annually, into similar manufacturing initiatives.

The M4 Grant Program has proven itself as a high-impact, forward-looking investment in Maryland's economic future.  Maryland is well-positioned to be a leader in advanced manufacturing as federal policy looks to reshore production, and the program not only supports the competitiveness of individual manufacturing, but also contributes to the broader goal of economic resilience, job growth, and industrial leadership. To maintain and increase this momentum, Maryland must deepen its commitment to the M4 program through a continued emphasis on technological innovation.

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# I. Introduction

Maryland embarked on a strategic initiative to modernize its manufacturing sector, recognizing the profound global transformation driven by Industry 4.0 technologies. This proactive endeavor was rooted in specific legislative action, namely Chapters 581 and 582 of the Acts of 2021, which became effective on July 1, 2021. These legislative acts established the Transforming Manufacturing in a Digital Economy Workgroup, also known as "Making It in Maryland," with the explicit mandate to develop policies and programs to facilitate the adoption of new Industry 4.0 technologies by Maryland manufacturers and to address emerging skills gaps in advanced technological environments.

The formation of this workgroup by bold legislative action, rather than as a reactive measure to economic decline, underscored a forward-thinking approach by the Maryland General Assembly. This proactive stance aimed to anticipate and shape the state's industrial future, positioning Maryland to attract advanced manufacturing investments and talent. Over a period of 16 months, from September 2021 to December 2022, the 24-member workgroup, composed of diverse stakeholders and chaired by Delegate Lily Qi, fulfilled its mandate. Its comprehensive final report, submitted on December 19, 2022, represented a pivotal step in shaping future state policies for manufacturing modernization and workforce development, laying a critical foundation for Maryland's continued economic competitiveness[1].

The Transforming Manufacturing Workgroup Final Report led to the writing and passing of Article - Economic Development §5–2401 through 5-2304 in the spring of 2023, establishing the Industry 4.0 Technology Grant Program in the Department of Commerce and mandating a minimum appropriation of $1,000,000 to the fund for fiscal years 2025 to 2028[2]. The statute requires that the grants shall be awarded to small (3-49 FTEs)[3] and mid-sized (50-250 FTEs) manufacturers, with 20% of the funds reserved for small manufacturers. Grants are set at a minimum of $25,000 and cannot exceed $500,000. A small manufacturer may apply for/receive funding for a total project value that is no more than 75% grant funded and no less than 25% company match funded. A mid-size manufacturer may apply for/receive funding for a total project value that is no more than 50% grant funded and no less than 50% company match funded. The funds are allocated on a competitive basis, hinged on legislation that demands project alignment with adoption of Industry 4.0 technologies, demonstrated overall commitment to Industry 4.0 technology adoption, and the demonstrated positive impact of the Industry 4.0 technology on the applicant’s business operations and competitiveness. In the program’s pilot year in FY23, $986,000 was distributed to 23 recipients. In FY24, $1,000,000

[1] Transforming Manufacturing Work Group meeting minutes and reports available at the following link: https://commerce.maryland.gov/commerce/transforming-manufacturing-workgroup

[2] Bill summary and legislative history available at the following link: https://mgaleg.maryland.gov/mgawebsite/Legislation/Details/HB0622?ys=2023rs

[3] FTE: Full-time employee. Defined as an employee who works at least 1,800 hours in a 12-month period.

was distributed to 26 recipients. In FY25, the General Assembly approved an addition of $4,000,000 to the stipulated $1,000,000, bringing the total for the M425 program year to $5,000,000.

The fund and accompanying appropriations were implemented to address the challenge of an increasingly globalized and technologically advanced economy, where small and mid-sized manufacturers face significant challenges in maintaining competitiveness and driving growth[4]. These challenges often stem from a lack of capital for investing in cutting-edge technologies, machinery, robotics, and digital transformation necessary to keep pace with larger competitors and evolving industry standards. Without targeted support, these businesses risk stagnation, reduced productivity, and potential job losses, thereby impacting regional economic stability. The Maryland Manufacturing 4.0 grant program addresses this critical gap by providing the necessary financial impetus for these manufacturers to modernize and innovate.

# II. Impact Framework

The M4.0 grant program aims to generate multi-faceted impacts, categorized as follows:

- Increased Throughput & Productivity: Enhancing operational efficiency, production capacity, and overall output, leading to increased sales.
- Enhanced Competitiveness: Strengthening the ability of Maryland manufacturers to compete more effectively domestically and internationally, and fostering innovation.
- Long-term Industry 4.0 Adoption: Promoting sustained integration of advanced technologies and digital practices for continuous improvement and future growth.
- Economic Growth: Contributing to the state's economy through increased tax revenue, job creation, and leveraged private investment.
- Workforce Development: Investing in human capital through upskilling, job creation, and fostering an energized and adaptable workforce.
- Cost Savings: Reducing operational expenses through automation, optimized processes, and efficient resource utilization.

[4] Available at the following link: https://ipc.mit.edu/wp-content/uploads/2023/08/WotF_Report_9.17.19.pdf

# III. Measurement Methodology

The data presented in this report are derived from impact reporting collected through the grant applications, survey responses, and grantee interviews. The authors diversified their analysis with varied quantitative and qualitative prompts. As discussed above, grant impact is not defined by one metric but rather a variety of criteria that we believe the funding from this grant can affect. We looked to measure all facets of business, from throughput, to AI usage, to workforce impact. Ultimately, we wanted to see Maryland's dollars generate a continued investment in advanced 4.0 technology beyond the program. As the first grant year to include additional grant dollars beyond the legislated $1,000,000, a particular focus was placed on the M425 grant year. While many of the M425 funded projects are nearing completion in their installation and training phases, we utilized company projections and early results to gauge the potentially substantial increased impact.

# IV. Facts and Figures

The program's impact is measured through a variety of key metrics, demonstrating significant positive outcomes. These visuals capture the impact of the first three years of the five year M4 program:

FIGURE I: Capital Expenditures Post-M4 Grant

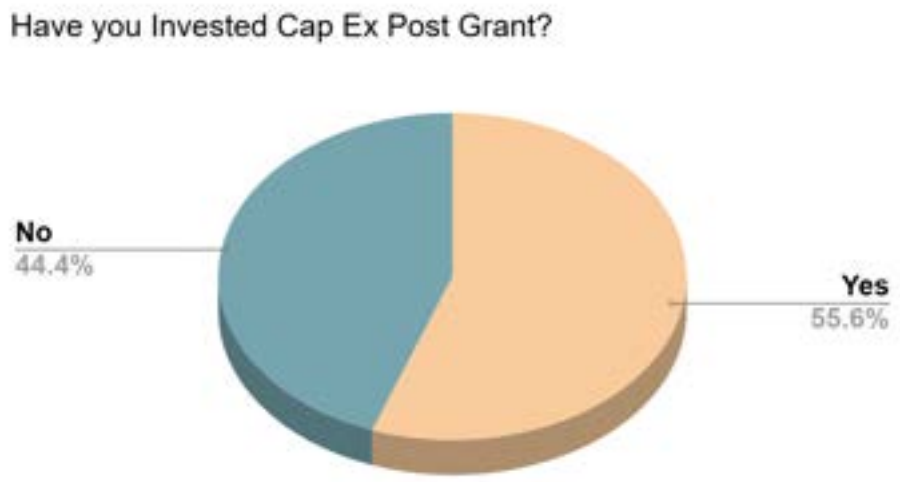



Figure I tracks the continued investment of Maryland manufacturers into advanced technology, at no cost to Maryland. Often these projects are the company's first step into Industry 4.0, but Maryland hopes they are not the last. Examples of significant post-grant investments include $150,000 for a capper addition to the state-funded bottling line (1.4x original grantee match), $250,000 for improvements to a motion control system (15.9x original grantee match), and $125,000 to add run time to the state-funded automated lathe (0.44x original grantee match).

# FIGURE II: Throughput Increases

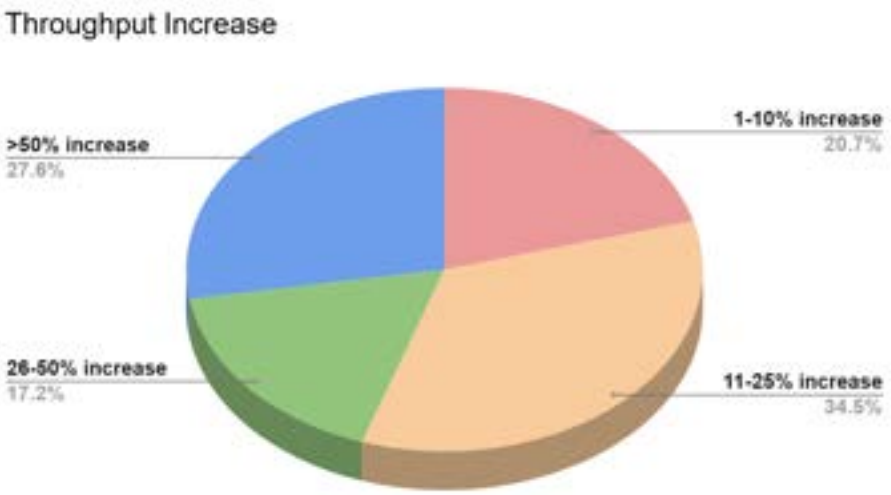
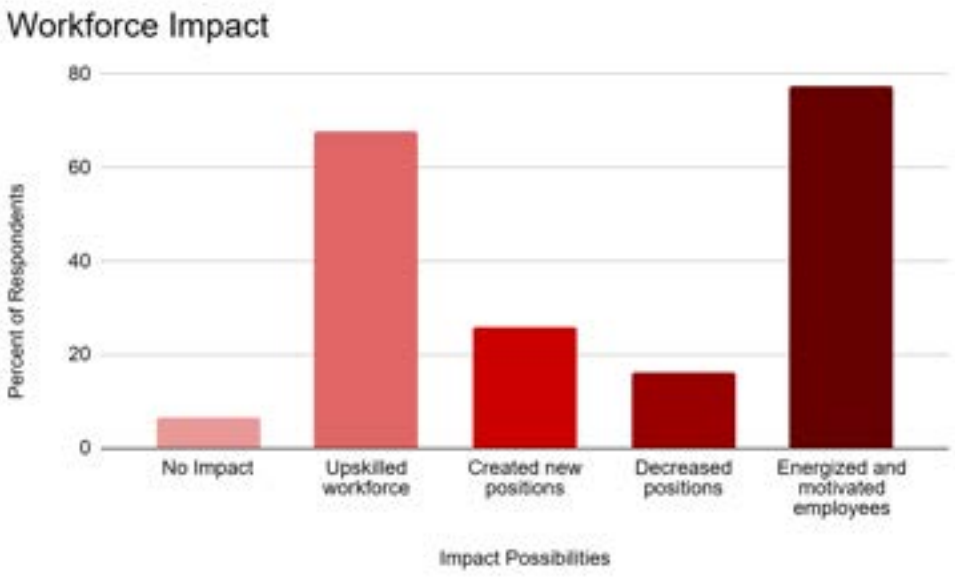



Figure II tracks one of the easiest assessments of this program's impact is throughput. While not all of the funded projects directly targeted increased throughput on the production line, all projects reported an improved production rate. These increases are largely not incremental, as 45% of grantees interviewed reported between 25% and 75% increases in production throughput while others that were interviewed reported much higher throughput increases—some well over 100%.

FIGURE III: Workforce Impact




Increased efficiency via advanced manufacturing techniques does not have to correlate with job loss. In fact, investment in Industry 4.0 technology encourages companies to upskill or hire new employees as time and resources are available to be allocated to different facets of operations. 67.7% of respondents reported an upskilled workforce, while 25.8% reported new hires. Overall, worker morale was significantly boosted with the implementation of advanced technology, contributing to a more positive work environment.

FIGURE IV: AI Usage

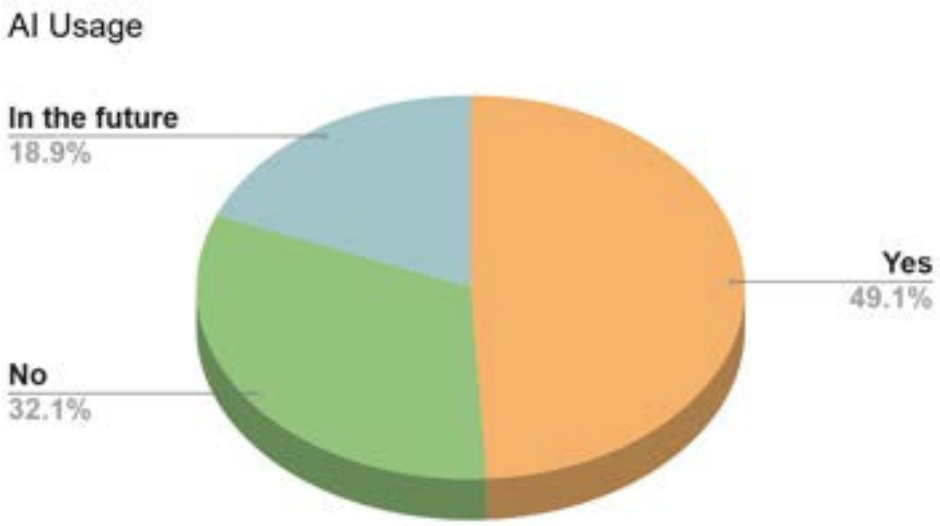
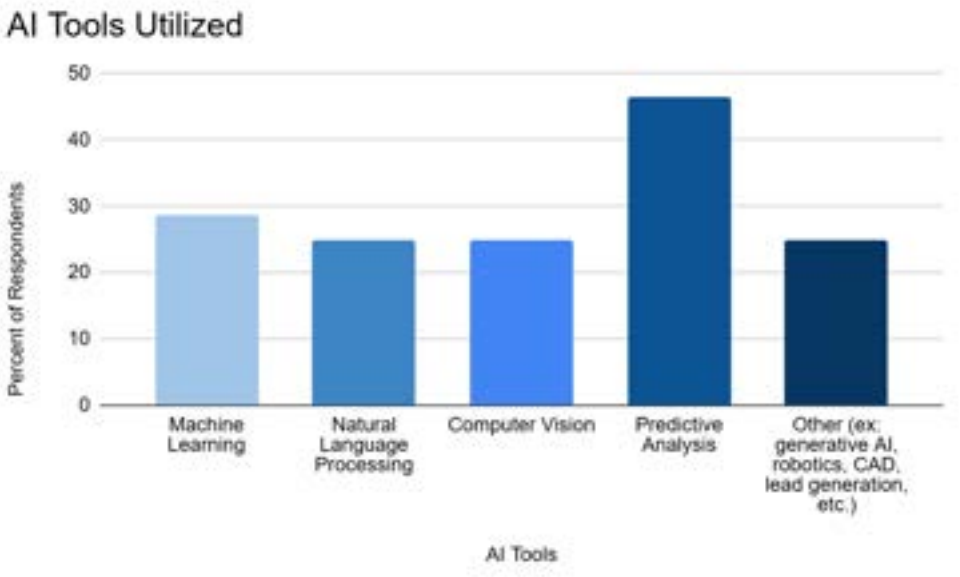



Figure IV tracks M4 Grant recipients current AI usage. It is not a requirement of the grant program, but is a lens through which Maryland can gauge how its manufacturers utilize 4.0 technology on a daily basis. The question is also meant to further elicit the use of advanced technology in and around the factory floor and office.

FIGURE V: AI Tools Utilized




From a production standpoint, AI in manufacturing is crucial for optimizing processes through predictive maintenance, reducing downtime, and enhancing quality control by identifying defects in real-time. Operationally, AI enables smarter decision-making by analyzing vast datasets, leading to improved supply chain management, more efficient resource allocation, and the development of highly adaptable and autonomous manufacturing systems. AI also does not have to come at a large cost to the manufacturer. We hope to see these numbers rise in the future as companies understand the benefits and efficiencies that can be gained by leveraging AI in their day-to-day operations.

# V. Stakeholder Outcomes

## Definition of Stakeholders

The primary stakeholders of the Maryland Manufacturing 4.0 grant program include:

- Small and Mid-sized Maryland Manufacturers: Direct beneficiaries receiving financial and strategic support.
- Employees of Grantee Companies: Benefiting from job security, upskilling opportunities, and improved working conditions.
- The State of Maryland: Benefiting from a stronger industrial base, increased tax revenue, sustained economic growth, and the opportunity to become a more inviting state for manufacturers.
- Local Communities: Indirectly benefiting from stable employment and economic activity.

# Testimony and Causality

Often causality can be difficult to determine when examining grant impact. However the mission of the Manufacturing 4.0 grant program is rather explicit in its pursuit of advanced technology adoption in the manufacturing sector. It is a project-driven grant program, meaning that companies must demonstrate not only initiative, but financial capital towards Industry 4.0 technology adoption in order to be eligible. A large majority of the throughput increases in the previous section are direct results of the modernization efforts of this program. Further feedback about the direct and causal impact of the M4 program lies in testimony which has been gathered in this section. In an optional, free-form response, grant recipients provided the following words in support of the program:

- Find Solid Corp - Metals (M425): "We had the laser machine come in by December last year, meanwhile we adjusted our production management to a more systematic way...Entering 2025, our weekly production is about 120k to 150k. About more than 50% ramp up from last year."
- Rugged Science - Electronics (M424): "This was a great way for a small business like ours to jump into an advanced technology like robotic welders. Without the grant, we most likely would not have made the jump and we are very glad we did..."
- Manor Hill Farms - Food & Beverage (M424): "We cannot overstate how dramatic the improvement has been as a result of the award of this grant and the installation of the subject equipment."

- National Jet - Metals (M425): "The LNS bar feeder has successfully automated... This expansion in capability has directly enabled National Jet to win new, higher-volume work..."

- Intuitive Machines, Inc. - Aerospace (M425): “The Maryland Manufacturing 4.0 Grant has had a significant impact on our business by enabling us to acquire the critical equipment necessary to advance our mission...This funding has accelerated our ability to integrate cutting-edge technologies such as thermal chambers, robotics, and sensors, which are essential for the design, manufacturing, and testing of space flight hardware. Without this support, acquiring these specialized tools would have been a major challenge.”

- Keen Industries, Inc. - Metals (M425): “This program is a gamechanger for us, since our manufacturing equipment typically runs between $150-400K per device. Having the M4 grant to help us modernize our fleet of equipment helps us compete with much larger companies which are often offshore, creating products of better quality while also ensuring that we can keep pace with the production quantities that our customers seek.”

- Fyodor Biotechnologies - Bio-manufacturing (M424): "The Maryland Manufacturing 4.0 Grant played a valuable catalytic role in our scale-up journey."

- Intuitive Machines - Aerospace (M425): "For a test in that size [thermal] chamber, we would probably see something around a savings of $12,000 each test we run within that chamber. So, that'll return on investment pretty quickly."

- Chesapeake Specialty Products - Metals (M425): "The second thing is we can actually push [the machine] harder... Right now, we don't run unmanned for the most part because when [backups] happen, it's a big mess to come in in the morning and clean it up. Whereas now there's equipment we can run after hours."

- Fluoron, Inc - High Performance Coatings (M425): "This project will have a huge impact on our business and community for us as it gave us the confidence to proceed with the project and accelerated our completion timeline by 1-2 years."

# Stakeholder Voices

Alongside testimony regarding the impact of the grant on Maryland manufacturers’ production capability and capacity, the voices of the manufacturers capture the impact of Maryland’s investment in its manufacturing ecosystem across all facets of the manufacturing plant.

- Amero Foods Mfg. Corp: "This has been a great program and we truly hope it continues. This is one of the main reasons we are in Maryland and keeping our jobs in the state."[5]

- HUB Labels: "This grant is critical to helping small/midsize manufactures remain competitive. The increased costs and labor shortages are heavily impacting manufacturing and we must continue to be innovative to build our future."

- Miltec Corporation: "The benefit to the State of MD is a stronger Miltec that can remain more competitive against other domestic, and more importantly, and foreign competitors, including China. This helps protect jobs and job growth resulting from Miltec investing in other growth opportunities."

- Keen Industries, Inc: "Additionally, the automation features enable longer unattended times with the machine, and that time is being utilized to increase productivity and train new hires. This gives us redundancy in tribal knowledge, improved morale, higher efficiency and a superior product with fewer rejects for the customer."

- Parker Plastics: "We view Industry 4.0 as not only a technology investment but also a cultural shift that empowers our team to operate smarter and more collaboratively."

# Outcomes

The grant program is delivering measurable results across multiple metrics, translating state? investment into tangible outcomes for Maryland's manufacturing ecosystem. For manufacturers, it has driven increased revenue and market share—evidenced by production ramp-ups and new, higher-volume contracts—while significantly improving operational efficiency, reducing waste, and boosting competitiveness on both domestic and global scales. For employees, the program has supported job creation, enhanced job security, and facilitated workforce upskilling through automation and role diversification, leading to more capable and resilient teams. It also contributes to a healthier work environment by reducing manual strain and increasing efficiency. For the State of Maryland, the program reinforces economic resilience by retaining jobs and manufacturing operations within the state, especially amid federal funding challenges, and delivers a strong ROI by leveraging company investment outside of the grant and spurring facility expansions that reflect long-term business growth.  Selected examples of outcomes are listed below.

- For Manufacturers:

    - Increased Revenue & Market Share: Demonstrated by "more than 50% ramp up" in production (Find Solid Corp) and winning "new, higher-volume work" (National Jet Company).

[5] Amero Foods Mfg. Corp employs 36 FTEs

    - Operational Efficiency & Cost Savings: Manor Hill Farm achieved "savings between 15%-35% in our Cost of Goods" and eliminated "6,000 double-lined plastic bags from our annual waste stream."

    - Enhanced Competitiveness: Companies like National Jet Company and Miltec Corporation are better equipped to "compete with much larger companies" and "against other domestic, and more importantly, and foreign competitors."

- For Employees:

    - Job Security & Creation: Over 25% of the respondents reported an increase in hires as a result of the grant project, with some companies expanding not only their manufacturing departments, but also sales and marketing teams as their business is set to expand.

    - Skill Development: Keen Industries, Inc. uses automation time to "train new hires," and Parker Plastics reassigned personnel to roles supporting "continuous improvement, preventive maintenance, and data analysis," contributing to a "more capable and versatile team."

    - Improved Work Environment: Kemp Proteins, LLC's robotic system "reduced human pipetting errors" and allows operators to "walk away from the unit," improving efficiency and potentially reducing manual strain.

- For the State of Maryland:

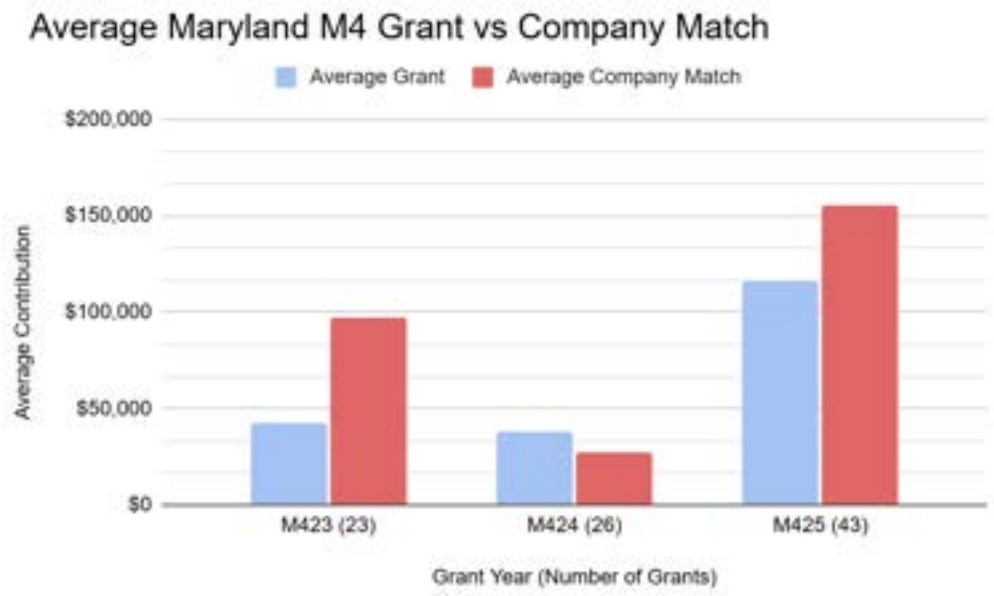
    - Economic Resilience: The program helps keep jobs and manufacturing in Maryland, as noted by Amero Foods Mfg. Corp and Intuitive Machines who stated: "The majority of our team here used to be on-site at NASA Goddard. And, unfortunately, with the recent turmoil with federal budget cuts and NASA losing a lot of funding, we've actually brought in most of that growth...from NASA Goddard."

    - Return on Investment: The program's ability to leverage company investment in additional capital outside of grant dollars (factor of 2.4x) maximizes the impact of state funds. Additionally, several companies reported that the substantive projects they were able to undertake thanks to Maryland’s dollars have caused such an increase in production capacity that they are looking to expand their facilities. Increased funding also leads to more long-term and complex projects overall, ensuring that Maryland companies remain competitive throughout the fourth industrial revolution.

# VI. Impact Analysis

The M4 grant program has demonstrated significant positive outcomes across various key metrics over its first three years. Grant funding has been distributed across a diverse range of industries, with notable increases in the M425 cycle allowing for a broader portfolio of targeted Maryland manufacturing sectors. Moreover, the M425 funding significantly expanded the program's regional diversification, extending investments into more counties across Maryland with substantial financial impact in each.

FIGURE VI: M4 Average Grant Project Breakdown




What the State of Maryland is able to leverage through its grants serves as a key metric in assessing the ROI for grant-funded initiatives, particularly when it reflects the commitment of grantees to exceed their stipulated match requirements. Figure VI demonstrates that on average, M423 and M425, grant recipients exceeded the required company match (25% for small manufacturers and 50% percent for mid-sized). M424's average company match is lower because 86% of the funding went to small manufacturers, thus requiring a lower match than the other two years (M423: 63% to small; M425: 70% to small). This additional investment by the companies beyond the required amount demonstrates a strong dedication to the project's success and amplifies the grant's impact. Companies showcase their belief in the program's value, effectively maximizing the reach and sustainability of the initial funding and indicating a robust partnership that extends well beyond mere compliance. The non-required additional capital spent by the grant recipients suggests that Maryland should shift the legislation to require higher matches, as companies are often already investing at rates above the minimum.

Relying solely on larger than required matches as a measure of impact can be insufficient; the complexity and size of the projects being conducted must also be assessed. While M423 and M424 grants have generated different levels of additional company spending, Figure VI showcases the low average grant size compared to M425. Thus, the associated funding in M423 and M424 was primarily channeled towards simpler, cheaper, and short-term requests, yielding immediate but less transformative results. In contrast, the increased funding available in grant M425 has enabled investment in significantly more complex projects. This shift has fostered an overall long-term vision, driving lasting change and innovation, particularly within the 4.0 technology sector, which goes far beyond what a simple leverage metric could convey. Where $1,000,000 in funding could go towards smaller grants investing in a smaller number of assets on a production line, increased funding of $5,000,000 or more allows for investment in multiple complex projects or even an entirely new production line in itself. This large scale investment ensures that companies are considering impactful progress towards complete Industry 4.0 adoption in not just one, but all phases of their business.

The program's most significant impact is on operational efficiency. Survey respondents and interview subjects consistently reported improved throughput, with a significant portion experiencing increases in production by double-digit percentage points. This positive trend was particularly pronounced for small manufacturers, highlighting the program's ability to drive substantial transformation in their production capabilities and sustaining Maryland's specialized manufacturing industry. Furthermore, the investment in Industry 4.0 technology has led to a more skilled workforce and new hires, contributing to a more positive work environment and demonstrating that efficiency gains can correlate with job growth and enhanced worker morale.

While the program has been widely successful across all grant recipients, there are a few companies that exemplify the great potential of continued heightened investment in Maryland manufacturing. A key aspect for success stories throughout the impact review process has been the larger grant award amounts. Both Intuitive Machines and Mid Atlantic Contracting, the companies highlighted in this section, received grants exceeding $200,000. The large grant amounts have allowed the companies to enact lasting impact on their company's vision for future manufacturing processes.

Intuitive Machines, a space exploration company headquartered in Houston, Texas and the manufacturer of the first spacecraft to land on the Moon since the Apollo missions, moved part of its operations to Maryland in 2021 and has continued to expand its presence in the state ever since. The move capitalized on Maryland's highly educated workforce and access to premier technology institutions such as the Johns Hopkins University Applied Physics Laboratory. Intuitive Machines was a recipient of a sizable $202,150 from the M425 grant pool, putting the funds to the purchase and installation of a thermal chamber, robotics, and sensors for the design, manufacturing, and testing of space flight hardware. This investment has allowed the company to bring its thermal testing in-house, saving an estimated $12,000 per test, as well as boosting their throughput an estimated five or ten times within the next year. The investments in infrastructure in their Maryland-based mechanisms facility in Glen Burnie has helped Intuitive Machines become one of three finalists for a $4.6 billion contract

with the NASA Artemis program which seeks to send the first astronaut to the moon since the successful Apollo 11 mission in 1969.

Mid Atlantic Contracting began as a General Contractor in 1995, but has since expanded to doing structural steel manufacturing, including manufacturing towers, tower pieces, and tower extensions largely used in the communication infrastructure industry. Mid Atlantic Contracting received $340,000 from the State of Maryland through the M425 grant program to invest in the automation of their welding processes while retaining and upskilling their employees in that sector. Additionally, the increased production that automation brings will require them to increase their employment in the steel manufacturing sector by a multiple of more than 3. The ability to upskill and add employees amidst modernization practices is not unique to Mid Atlantic, but they are an ideal example of how workforce development and advanced manufacturing can and should coexist.

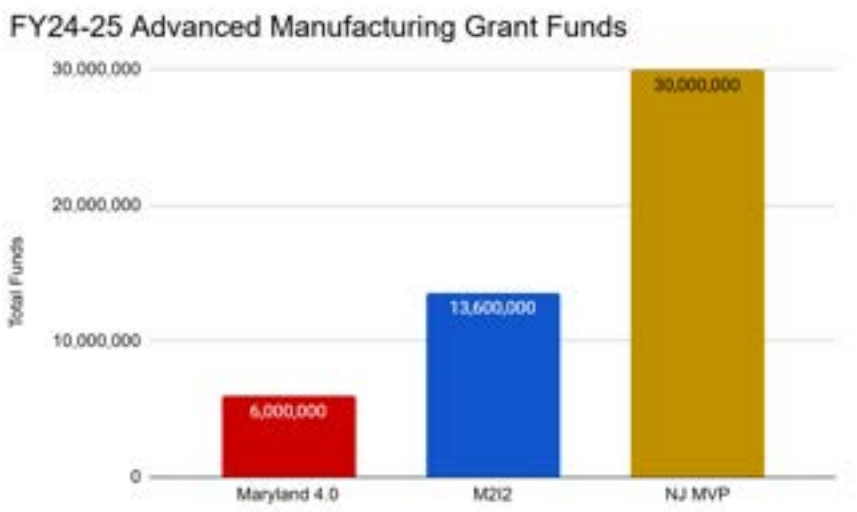
# VII. Future Goals and Strategies

Building on its demonstrated success, future goals and strategies for the M4 grant program emphasize the critical need for sustained and expanded funding. The manufacturing grant budgets of several competing states range from $5,000,000 to $32,000,000 per year. Increased financial commitment to manufacturing is essential for Maryland to effectively compete with states like Massachusetts, which have robust and well-funded programs supporting advanced manufacturing. The Massachusetts Manufacturing Innovation Initiative (M2I2) has invested over $100,000,000 within the past decade, including $13,600,000 in the past two years, a time span in which Maryland has managed $6,000,000 in advanced manufacturing investment.[6] Maryland's highly educated and high tech workforce, combined with its innovative industries and higher than average tax structure, finds itself with many comparisons to Massachusetts. New Jersey's Manufacturing Voucher Program (NJ MVP) has committed $63,000,000 to over 300 manufacturers in the state since the project was piloted in October 2022.[7]

[6] More information on M2I2 can be found at this link: https://cam.masstech.org/m2i2

[7] More information about the NJ MVP program can be found here: https://www.njeda.gov/mvp3/

# FIGURE VII




Increased funding for the M4 program would prevent Maryland from falling behind its competitors in advanced manufacturing. To attract and retain manufacturing businesses, Maryland must offer competitive incentives and support that align with or exceed those of leading states, ensuring Maryland remains a desirable location for industrial growth and innovation.

Furthermore, greater funding directly contributes to increasing Maryland's business friendliness, which currently sits at a below average 32nd in the nation, having fallen from 12th in 2021.[89] By having more grant funding available for the M4 program, Maryland can signal a strong commitment to its manufacturing sector, fostering an environment where businesses feel supported in their efforts to modernize and expand. This not only encourages existing manufacturers to stay and grow in Maryland but also serves as a powerful magnet for new companies looking for a proactive and investment-minded state partner with a talented and educated workforce. A well-resourced grant program simplifies the path for businesses to adopt cutting-edge technologies, reducing financial barriers and administrative hurdles.

[8] Available at this link: https://www.cnbc.com/2021/07/13/americas-top-states-for-business.html

[9] Available at this link: https://www.cnbc.com/2025/07/10/maryland-top-states-for-business-ranking.html

# FIGURE VIII


Finally, enhanced funding would enable the M4 program to better match the increasing and evolving requests from grantees. The $5,000,000 from the M425 was able to cover 80% of the $6,299,033 requested from the 43 grant recipients. The M424 program covered 70% of the requested $1,610,964. The M423 program effectively covered 96% of the requested $1,022,788. However, looking at Figure VIII, the outstanding demand for investment in 4.0 technologies is substantial, and Maryland has only been able to contribute a fraction of it. With larger appropriations, the program can provide more substantial grants to support a greater number of complex projects across the many industries and counties that encompass Maryland's manufacturing ecosystem. This ensures that the program remains responsive to the industry's needs, maximizing its impact on throughput, productivity, and overall economic growth within Maryland.

Future goals for Maryland manufacturing include a strong emphasis on workforce development. While the testimonials are overwhelmingly positive, one comment from ATI Performance highlights a persistent challenge that has rung true for many of the manufacturers we talked with: "We do not have quality issues...We have manpower issues...No matter how many machines and how much tech you throw at a shop, you still need people." This suggests that while technology adoption is crucial, the underlying human capital challenges, particularly labor shortages, remain a significant concern for manufacturers. Workforce initiatives should complement the 4.0 technology adoption that M4 targets by building a robust talent pipeline, potentially through apprenticeships, specialized training for emerging technologies, and outreach efforts to attract diverse talent. Another key future goal is to showcase best practices by highlighting successful case studies from grantees, thereby inspiring other manufacturers to embark on their own Industry 4.0 journeys. Finally, the program will focus on measuring long-term ROI by continuing to track and report on the

economic benefits to Maryland, such as increased tax revenue and sustained job growth, to further demonstrate the program's value and ensure its continued success.

The national push to reshore manufacturing also presents a generational opportunity for Maryland. As federal policies and private-sector trends converge to reduce reliance on overseas supply chains, states with robust manufacturing support infrastructure stand to gain the most. Maryland, benefiting from both a strong geographic location as well as a strong M4 grant program, is well-positioned to capture this momentum by helping local firms modernize, scale operations, and serve as resilient nodes in re-domesticated supply chains. Strategic investments in smart manufacturing now can turn Maryland into a destination for reshored production supporting high-value industries such as aerospace, life sciences, and advanced materials.

# VIII. Conclusion

The Manufacturing 4.0 Grant Program stands as a strategic pillar in Maryland's commitment to securing its economic future through innovation and modernization. By targeting small and mid-sized manufacturers, the program has effectively bridged the gap between emerging technologies and the operational realities of local businesses. The results from the first three years demonstrate a clear ROI: increased productivity, stronger workforce capabilities, enhanced global competitiveness, and millions of dollars in leveraged company capital investment. These outcomes affirm that Maryland's early legislative foresight and targeted grant design are paying dividends.

At its core, the M4 program is not just about technology upgrades—it is about transformation. It empowers manufacturers to fundamentally reimagine their operations for the long-term. It encourages companies to think beyond individual machinery upgrades and toward system-wide integration of Industry 4.0 practices. The data and testimonials gathered underscore how this initiative has helped manufacturers make bold investments they may not have pursued alone, leading to durable improvements in production efficiency, cost savings, and production capacity. In a time of rapid technological change, Maryland's commitment to supporting modern manufacturing sends a powerful signal of forward-thinking and adaptability. However, to fully realize the program's long-term potential, continued and expanded investment is essential. This will also help Maryland manufacturers capitalize on the opportunities presented as federal economic policies look to reshore manufacturing. Increasing the M4 grant program's annual funding will allow the state to accommodate growing demand, support larger and more ambitious projects, and remain competitive with peer states investing aggressively in this space.

# IX. Appendix

## TABLE I: GRANT FUNDING BREAKDOWN BY INDUSTRY

| SUM of Grant | Year | | | |
|---|---|---|---|---|
| Industry | M423 | M424 | M425 | Grand Total |
| Aerospace | | $25,000 | $311,034 | $336,034 |
| Apparel | $50,000 | $26,482 | $408,971 | $485,453 |
| Batteries | | | $320,000 | $320,000 |
| Bio-Manufacturing | | $44,000 | $349,649 | $393,649 |
| Coatings | | | $104,365 | $104,365 |
| Defense | $113,290 | $30,711 | $59,275 | $203,276 |
| Education Materials | | $25,000 | | $25,000 |
| Electronics | $143,353 | $233,850 | $299,399 | $676,602 |
| Filters | | $28,650 | $472,200 | $500,850 |
| Food & Beverage | $242,073 | $135,130 | $760,651 | $1,137,854 |
| Machinery | $174,240 | $161,578 | $102,367 | $438,185 |
| Medical Devices | | $38,647 | | $38,647 |
| Metals | $96,770 | $57,772 | $1,239,630 | $1,394,172 |
| Millwork | | $57,000 | $203,417 | $260,417 |
| Packaging | | $102,430 | | $102,430 |
| Personal Care | | | $50,000 | $50,000 |
| Plastics | | $33,750 | $70,823 | $104,573 |
| Printing | $116,674 | | $92,766 | $209,440 |
| Seafood Processing | | | $105,453 | $105,453 |
| Signs | $50,000 | | $50,000 | $100,000 |
| Grand Total | $986,400 | $1,000,000 | $5,000,000 | $6,986,400 |

Table I displays the breakdown of grant funds by industry. Notably, the increase in funding in M425 allowed for a more diverse and comprehensive portfolio of industries, targeting all facets of Maryland manufacturing. 20 industries have been covered by the M4 program, 17 of which received funding during the M425 campaign.

# TABLE II: GRANT FUNDING BREAKDOWN BY COUNTY

| SUM of Grant | Year | | | |
|---|---|---|---|---|
| County | M423 | M424 | M425 | Grand Total |
| Allegany | | | $60,686 | $60,686 |
| Anne Arundel | $23,897 | $133,458 | $350,630 | $507,985 |
| Baltimore City | $338,843 | $375,849 | $581,452 | $1,296,144 |
| Baltimore County | $240,914 | $114,000 | $452,652 | $807,566 |
| Carroll | | | $450,000 | $450,000 |
| Cecil | | | $516,704 | $516,704 |
| Frederick | $50,000 | $40,000 | $203,916 | $293,916 |
| Harford | | | $1,059,589 | $1,059,589 |
| Howard | $69,211 | $112,500 | $260,863 | $442,574 |
| Kent | | | $52,509 | $52,509 |
| Montgomery | $50,000 | $25,000 | $315,732 | $390,732 |
| Prince George's | | | $157,142 | $157,142 |
| Queen Anne's | $50,000 | | $62,757 | $112,757 |
| Somerset | | $64,250 | | $64,250 |
| St. Mary's | $13,536 | $29,647 | $45,284 | $88,467 |
| Talbot | | | $216,543 | $216,543 |
| Washington | $50,000 | $67,296 | $154,266 | $271,562 |
| Wicomico | $50,000 | $38,000 | | $88,000 |
| Worcester | $50,000 | | $59,275 | $109,275 |
| Grand Total | $986,400 | $1,000,000 | $5,000,000 | $6,986,400 |

The impact of the expanded funding from M425 on regional diversification is apparent in Table II as 17 counties received an average of $294,118 in the M425 cycle, a large step up from the 10 counties receiving grants in the M424 cycle. Not only did the $5,000,000 in allotted grant money allow the State of Maryland to geographically disperse its investment into more counties, it could do so with significant impact and dollars (e.g. $450,000 in Carroll County, $1,059,589 in Harford County, $216,000 in Talbot County, and $516,704 in Cecil County)

# TABLE III: SUMMARY TABLE

| | Recipients Contacted | Survey Responses | Response Rate (%) |
|---|---|---|---|
| M423 | 21 | 12 | 57% |
| M424 | 24 | 14 | 58% |
| M425 | 43 | 28 | 65% |
| Total | 88 | 54 | 61% |

This is a brief overview of the methodology of this report. All the grant recipients from M423, M424, and M425 were contacted via email with a survey unless they had already defaulted on their grant.[10] The survey varied slightly depending on the program year to account for different stages of project completion. Twelve companies from the M425 cycle were also contacted for an informational web meeting, of which nine completed.

# M425 Case Studies

## Micropore, Inc.

- Filters; Cecil County
- Total Project Cost: $660,000
- Commerce Grant: $312,000
- Company Contribution: $348,000 (3.3x required contribution)

Micropore, Inc.'s proposed automation and systems integration project will significantly enhance the company's operational efficiency and competitiveness in the medical-grade carbon dioxide absorption market. As demand grows following the successful introduction of new products into the medical anesthesia sector, this investment will allow Micropore to scale production capacity, reduce variable costs, and elevate quality standards. Specifically, the project includes the implementation of Industry 4.0 technologies such as robotics, embedded systems, and advanced sensors—targeting measurable improvements in scrap rates (from 5% to under 1%), variable cost per unit (from $15.08 to $8.45), and overall equipment effectiveness (from 65% to 90%).

[10] 2 companies in both M423 and M424 defaulted and thus did not receive a survey.

The broader impact on the State of Maryland is equally compelling. Located in Cecil County, Micropore's $660,000 initiative—supported by the $312,00 in grant funding—will result in the creation of high-skilled engineering, programming, and operations jobs, while also upskilling existing staff through hands-on training in robotics, human machine interface, and project logic controller integration. The project aligns directly with Maryland's M4 strategic priorities by modernizing critical life-support manufacturing infrastructure with energy-efficient, sustainable systems. Micropore's investment in clean manufacturing and medical technology innovation helps position Maryland as a center of excellence for advanced, export-oriented production in regulated industries.

## Chesapeake Specialty Products, Inc.

- Metals; Baltimore County
- Total Project Cost: $623,672
- Commerce Grant: $157,500
- Company Contribution: $466,172 (9x required contribution)

The proposed Industry 4.0 modernization project by Chesapeake Specialty Products, Inc. (CSP) will have a significant impact on both the company's operations and the broader Maryland manufacturing landscape. By implementing advanced factory automation, real-time data integration, and intelligent control systems—including sensors, human-machine interfaces (HMI), and the FactoryTalk View SE platform—CSP aims to improve production efficiency by 30%, reduce downtime, and proactively manage equipment maintenance. This investment not only enhances product quality and operational safety, but also enables CSP to increase output to serve emerging sectors like offshore wind, positioning the company for long-term growth and resilience.

For the State of Maryland, this project represents a strategic win. CSP's initiative reinforces the state's commitment to revitalizing legacy industrial sites through smart technology and sustainable manufacturing practices. The project will retain critical industrial jobs in Baltimore County while creating an estimated 3–5 new positions in middle management, production, and maintenance. Moreover, by improving energy efficiency and supporting compliance with environmental and occupational safety standards, CSP is helping to lead the way for Maryland manufacturers adapting to a cleaner, data-driven industrial future. This grant will help anchor CSP's competitiveness in national and global markets while reinforcing Maryland's leadership in advanced manufacturing innovation.

## Hardwire, LLC

- Defense; Worcester County

- Total Project Cost: $118,551
- Commerce Grant: $59,276
- Company Contributions: $59,276

Hardwire, LLC, an armor manufacturer on the Eastern Shore, has invested in a Fanuc R2000 series robot. The robot will support the company's expansion into advanced metallurgy work specifically for laser cutting, welding, and grinding steel and titanium to produce large single-piece truck and tank hulls, hatches, and material handling equipment. This project offers significant benefits to Maryland by strengthening its industrial base and contributing to socioeconomic growth. Hardwire anticipates a 10% increase in full-time professional positions, creating direct and indirect job opportunities in engineering, manufacturing, and supporting industries on the Eastern Shore and across Maryland. This will also aid in skill retention within the state.The project's focus on material and energy efficiency, and reduced environmental impact, also aligns with sustainability goals, while the creation of high-quality armor solutions for the U.S. military will enhance national readiness.

Hardwire's grant request demonstrates a strong commitment to long-term Industry 4.0 adoption by consistently investing in advanced automation. Their successful 2023 M4 grant, which supported the acquisition of two UR20 robots for body armor manufacturing, highlights a deliberate and incremental approach to integrating new technologies. This new request for a Fanuc R2000 series robot for advanced metallurgy signifies a continued and expanding embrace of automation, moving beyond initial efficiency gains to tackle more complex manufacturing processes like laser cutting, welding, and grinding of large steel and titanium components.

## National Jet Company, Inc.

- Metals; Allegany County
- Total Project Cost: $80,915
- Commerce Grant: $60,686
- Company Contributions: $20,229

National Jet Company, Inc., a precision manufacturer in LaVale, Maryland, sought to integrate a Miyano BNE65 MYY CNC Turning Center, an LNS Sprint 565 S2 12' Magazine Bar Feed, and a Royal Rota-Rack with Deluxe Control. This $80,915 project is a critical step in their Industry 4.0 strategy to achieve 'lights out' machining, enabling continuous, unmanned production. The LNS bar feeder doubles the maximum diameter of automatically fed bar stock to 65mm, allowing National Jet to secure new, higher-volume contracts for large part production. Concurrently, the Royal Rota-Rack automates the safe collection of heavy, high-value parts, preventing damage that previously occurred from a four-foot drop and significantly improving overall yield by minimizing nicks and dings.

This automation will drastically increase National Jet's operational capacity from 40 hours to 168 hours per week, enabling them to fulfill demanding contracts, such as one requiring 1,980 machining hours by December 2025, which would have been impossible without this investment. The project will also create up to two new full-time support positions and upskill 1-2 current employees in advanced machining and quality control. Furthermore, it will improve energy efficiency by reducing power consumption per part, eliminating machine idle time, reducing material waste by 67% due to the use of full 12' bar stock instead of 4' bars, and shifting energy demand to off-peak hours, bolstering Maryland's industrial base and promoting technological innovation and sustainability.

## Amero Food Manufacturing Corp. (Pastry Star)

- Food & Beverage; Howard County
- Total Project Cost: $992, 290
- Commerce Grant: $190,040
- Company Contribution: $802,250 (12.7x required contribution)

The proposed project by Amero Foods Mfg. Corp. (PastryStar) represents a high-impact investment in advanced manufacturing that will strengthen both the business and Maryland’s broader industrial ecosystem. By integrating Industry 4.0 technologies (SCADA systems, ERP modernization, and robotic automation) PastryStar aims to boost production efficiency by 30% and reduce material waste by 20%. These upgrades will streamline operations, improve batch traceability and food safety, and significantly reduce rework and energy consumption. Importantly, this transformation will allow PastryStar to meet increasing demand from major clients such as Whole Foods, Wegmans, Costco, and Panera Bread, while enhancing competitiveness in a highly specialized clean-label food manufacturing market.

For Maryland, the economic and workforce benefits are substantial. The project will create new skilled positions, including a production manager and project manager, and will support the reskilling of existing staff through tailored training in automation, data analytics, and ERP systems. As a result, PastryStar will serve as a model for small-to-mid-sized manufacturers in the state seeking to adopt digital technologies. The project aligns directly with Maryland’s Manufacturing 4.0 priorities by fostering innovation, sustainability, and growth in the food manufacturing sector—an industry critical to the state’s economy. Furthermore, the company stated that the M4 program was one of the primary reasons it has kept its operation in the state, a key indicator that attentiveness to advanced manufacturing increases Maryland’s business friendliness.

## Dunlop Protective Footwear, LLC

- Apparell; Harford County
- Total Project Cost: $1,167,290
- Commerce Grant: $408,971
- Company Contribution: $758,319 (1.85x required contribution)

Dunlop Protective Footwear's proposed Material Handling Automation project represents a transformative investment that will significantly enhance its operational efficiency, safety, and competitiveness in Maryland. By integrating an advanced automated system—including conveyors, an AutoStore robotic storage solution, and an Autobagger with auto-labeling and shrink-wrapping capabilities—the company plans to double its storage and packaging capacity from 6,000 to 12,000 pairs of protective boots per day. This leap in productivity will support expansion opportunities, reduce workplace injuries tied to manual handling, and improve packaging accuracy, which currently accounts for over half of the company's technical complaints. Moreover, with enhanced real-time inventory management and data-driven optimization, Dunlop will increase speed and quality while minimizing waste and energy use.

The impact on the State of Maryland is equally significant. As one of the state's leading manufacturers of safety footwear, Dunlop's substantial investment will secure and grow high-value manufacturing jobs in Harford County, while serving critical sectors like food processing, energy, and construction. The project will also upskill the existing workforce through hands-on training in robotics, AI, and data analytics, aligning with Maryland's commitment to Industry 4.0 transformation and workforce modernization. The adoption of energy-efficient systems further supports the state's economic development and sustainability goals, reinforcing Maryland's leadership in advanced manufacturing innovation and supply chain resilience.