

Restoring the American Manufacturing Base: Is It Feasible?

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This paper evaluates the historical decline and current resurgence of the U.S. manufacturing sector by analyzing major factors: outsourcing, globalization, technological advancements, and the effects of the COVID-19 pandemic on supply chain vulnerability. This analysis will also include how workforce development, technological innovation, resilient supply chains, policy reform, infrastructure investments, and intersectoral collaboration all contribute to the renaissance of America's manufacturing base. Policymakers are encouraged to update regulations to accommodate Industry 4.0 (including AI) skill sets, provide funding for worker training, and establish Public-Private Partnerships (PPPs) to develop regional manufacturing clusters. They should also localize supply chains and provide equitable access to capital for small and medium-sized enterprises (SMEs). While this paper acknowledges that challenges remain, it provides evidence that through a coordinated effort among technology, education, infrastructure, and inclusive policy, America can restore a competitive manufacturing landscape. The move will lead to growth, enhanced national security, and shared prosperity.

Keywords: manufacturing, globalization, outsourcing, technology, and supply chain

INTRODUCTION & BACKGROUND

A strong manufacturing base has historically underpinned the US economy. Recently, global shocks, disruptions, and changing technology have revealed both vulnerabilities and opportunities for US manufacturing. This white paper not only discusses the historical context of US manufacturing and recent shocks and disruptions (including the COVID-19 pandemic) but also suggests the factors needed to reinvigorate US manufacturing. These factors are related to workforce development, advanced technology, supply chain resilience, and broader

policy support. The white paper makes key recommendations that consider the factors and discuss how to act on them to revitalize, improve, and build a competitive, innovative, and resilient US manufacturing base in the future.

HISTORICAL CONTEXT & RECENT CHALLENGES

The following section examines several significant historical forces and recent shocks that have shaped the US manufacturing sector. From the “Golden Era” of invention and mass production, through decades of globalization and offshoring, to the rapid pace of automation and the COVID-19 pandemic’s shocks, American industry has undergone a significant transformation. The history of invention, global competition, technology, and crisis-induced weaknesses will create a foundation for understanding why it is imperative to rebuild and modernize the US manufacturing base.

Invention and Aspirations: The Golden Era of US Manufacturing

The proverbial “Golden Era” of manufacturing in the United States spanned roughly from the late 19th century to the mid-20th century, marked by extraordinary industrial growth and innovation, as well as the emergence of mass consumption. The Fordist methods of mass production did not simply characterize this era; they also marked the birth of Sloanism. A Sloanian model, as demonstrated by General Motors under Alfred Sloan, was centered on consumer-related factors, such as marketing, consumer credit, and product differentiation. Sloanism contrasted with a wage-oriented Fordism system by creating and cultivating consumer demand through innovative financing, advertising, and frequent product updates. It laid the groundwork for a high-wage and high-consumption economy that extended beyond the factory floor into American society (Medeiros, 2000). The backdrop for this dynamism included Americans’ unusual capabilities in invention and technological improvement. Recent studies reveal that the United States’ golden age of innovation depended on a diverse array of inventors who benefited from the US labor force, density, education, financial development, and geographic predispositions at the time. The country was also highly conducive to upward mobility: inventors were inclined to migrate to areas that fostered inventiveness and yielded strong financial returns for their efforts and creations (Akcigit et al., 2017). The patent system was relatively accessible and open to broad participation in technological development. The emerging example of corporate laboratories of research and development also suggested that the institution of technological development was becoming rapidly institutionalized. In other words, economic certainty, stability, and growth became organizationally entrenched in US institutions, such as education and employment.

Offshoring and Globalization

The decline of manufacturing employment in the United States over the last forty years is closely associated with the larger phenomenon of offshoring and globalization. In their desire to reduce labor costs and increase profits, American firms shifted manufacturing jobs to other countries, many of which had lower wages and fewer regulations. By the end of the twentieth century, this development had reached a fever pitch, significantly impacting employment levels in basic manufacturing industries, including fabricated metals, machine manufacturing, computer and electrical products, and clothing and textiles. These once major sectors of the US economy collectively shed more than 80% of their jobs between 1979 and 2019 (Harris, 2020). According to Harris (2020), offshoring production led to significant reductions in the share of the total US workforce employed in manufacturing, from 22% in 1979 to 9% in 2019. Offshoring also put greater pressure on durable goods industries to recover from recessions, and few did.

The case of Detroit, once a global center of American manufacturing, exemplifies the impact of globalization on US manufacturing. Liu (2020) describes how the city, after a postwar golden age, became a target of international competition, especially from automakers in Europe and Japan. In the early 1960s, US automakers accounted for nearly 44% of the global car market. However, by 1991, this figure had dropped to less than 19%, representing a loss of almost a quarter of the overall market to foreign competition. This contraction of the market ultimately placed the Big Three American car manufacturers in

financial distress, which culminated in a federal bailout in the early twentieth century. The decline of Detroit exemplifies the nature of single-industry cities, whose economies face significant restructuring and consequences from offshoring and global competition, resulting in mass layoffs, population loss, and ultimately, deep social and financial crises.

Technological Change and Automation: A Double-Edged Sword

The rise of automation has transformed the US manufacturing landscape, often leading to the loss of traditional employment opportunities for American workers (Marto and Le, 2025). Digital automation has eliminated many clerical and production jobs since the 1980s, resulting in job losses and declining wages for workers whose jobs could be easily automated (Holzer, 2022). As automated technology becomes increasingly sophisticated, the pressure on workers to keep pace is mounting. New jobs are being created, albeit primarily for those with a high level of technical literacy, such as engineers and technicians. Samuels and Pelser (2025) cite, in their paper, that the new paradigm, known as Industry 4.0, involves incorporating technologies such as cloud computing, big data, the Internet of Things (IoT), embedded systems, and artificial intelligence (AI) (Samuels & Pelser, 2025, p. 1). While these systems may be innovative and time-efficient, they may not be accessible to all employees (particularly immigrants or uneducated low-skilled laborers) (Holzer, 2022). Developing abilities and skills to stay abreast of technological changes (Samuels & Pelser, 2025, p. 2) is a worthy and noble goal, but it is also complex. In their quest for ever-increasing efficiency, organizational managers and owners may lose sight of what makes organizations great—the employees that support, foster, and facilitate operations. Advancements in industrial automation are driving the resurgence of jobs in the United States. However, those jobs can require more technical skills than those available to the manufacturing workforce (Corvalent, n.d.).

COVID-19 & Foreign Dependency

The COVID-19 pandemic revealed substantial challenges for US manufacturing, underscoring the country's significant reliance on global supply chains for essential goods and services. During the pandemic, industries and consumers in the US faced significant shortages of personal protective equipment (PPE), pharmaceutical products, semiconductors, and other essential goods. They recognized the risks of being heavily dependent on foreign suppliers for necessary products and components. Asia, for instance, was one of the world's heavily relied-upon regions (Weinman et al., 2021). The egregious shortages were more than logistics, shipping, or fulfillment issues; they were the result of years of offshoring and lean inventory policies that had built supply chains for efficiency rather than resilience. US manufacturers were unable to pivot to US-sourced substitutes as factories worldwide closed and global shipping options ceased.

According to Weinman et al. (2021), the pandemic prompted an initial reconsideration of global supply chain practices and the US's dependency on them. A better understanding of the hazards associated with excessive reliance on suppliers for essential products, especially during critical periods, emerged. This led to increased interest in reshoring manufacturing, reinventing supply chains for greater diversification, and using digital tools to improve supply chain visibility and agility. The disruption caused by COVID-19 also prompted increased interest and investment in the revitalization of domestic manufacturing, particularly for goods and services deemed essential to national security objectives and public health.

Kersan-Škabić (2021) provides a global perspective on the pandemic experience, highlighting changes in international trade relations and a shift back towards regionalization and localization. Tariffs and export restrictions, along with social distancing and production interruptions, made global sourcing less readily accessible (particularly for national actors accustomed to it).

COVID-19 prompted Biden, then the sitting president of the United States, to seek domestic solutions to some of the crises the US faced during the pandemic. For instance, he promised to use the Defense Production Act (DPA) to increase U.S. companies' production to meet critical short-term needs (Weinman et al., 2021). He also promised to use federal buying power to increase the manufacturing of vital products, such as PPE and other essential equipment. Upon taking office, Biden invoked the DPA, which strengthened vaccine production and ensured greater access to testing and PPE. He used the US tax code to encourage

the pharmaceutical supply chains to relocate American manufacturing jobs to the United States (Weinman et al., 2021).

COVID-19 disruptions prompted reconsideration of the United States' supply chain dependencies, as well as manufacturers' supply chains, enabling some tariffs and restrictions to serve as agents for national solidarity purchases. Tariffs are intended to stimulate national economies, but increased expenses, continually rising tariffs, and the pandemic led some manufacturers to rely on the same regions for their products. New actions and reconsiderations have led to a newfound investment in potential future domestic production and regional supplies in the United States and other countries. Because the United States realizes that reliance on foreign entities for critical products is a problem rather than an asset, there are opportunities to reinvigorate and reinvest in domestic manufacturing sectors.

The implementation of tariffs, especially during the United States-China trade war, also shifted the US's manufacturing strategy. The United States imposed broadly applied tariffs on Chinese products (Siripurapu et al., 2025). These tariffs were sustained and augmented by the subsequent administration, and many American corporations assessed the risk of manufacturing or sourcing from foreign suppliers due to their reliance on those companies. While the tariffs increased importers' costs, they were also seen as a factor in reshoring, as manufacturers began producing in the United States to avoid future trade risks and potential disruptions. The trade policy, coupled with a pandemic-driven supply shock, sharpened the debate over US economic security and increased both private and public investment in US-based manufacturing (specifically, semiconductors and clean energy). While the long-term effectiveness is debatable, there is no denying that tariffs have realigned trade paradigms and fostered new energy towards United States-based manufacturing.

Effectively, a combination of fears about overreliance on foreign manufacturing for critical products and PPE, as well as higher tariffs during the Trump administration, prompted the United States to recalibrate and rethink its manufacturing sector, which was—at the time—heavily offshored. While globalization remains the entrenched modality in manufacturing, with US companies continuing to depend on foreign countries for products for various reasons, a distinct opportunity has emerged for onshore manufacturing.

KEY FACTORS IN REBUILDING THE US MANUFACTURING BASE

Introduction

Reinvigorating America's manufacturing base requires a comprehensive understanding of the influences of the 21st century. Global competition and technological evolution will continue, and adaptation will be paramount to success. Economies of the future will depend not only on adopting technologies and revamping manufacturing processes but also on fostering a labor force, establishing diverse supply chains, and developing policy environments that spur growth and innovation. The following section analyzes key components, including the labor force and skills development, technological innovation, resilient and local supply chains, the policy and regulatory environment, infrastructure and energy, and access to capital. Addressing these interdependent components enables policymakers and industry leaders to establish a framework for a successful, resilient, inclusive, robust, and adaptive manufacturing renaissance.

Workforce Development & Skills Training

The swift evolution of computerization and artificial intelligence (AI) is fundamentally transforming the US manufacturing workforce, and workforce development and skill training have become key factors in rebuilding the US manufacturing capacity. As robots and AI systems assume greater responsibility for routine and repetitive tasks, the demand for traditional manufacturing skills decreases, while the need for new technical, analytical, and soft skills increases. This transition creates both risks and rewards for workers, employers, and policymakers alike.

Moe and Rodgers (2024) indicate that the effects of automation on jobs are complex and nuanced. While robots and AI can displace workers, particularly those in routine manual roles, they can also create new work roles and positions. For instance, robots in manufacturing have created new jobs in programming, data maintenance, data mining, and system review. These jobs often require higher education or specialized

training; therefore, reskilling and upskilling are necessary for workers who want to continue engaging in meaningful employment. As noted earlier, the effects of automation are not felt equally: displaced and depressed wages are more likely to affect low-skilled and low-income workers, workers in regions with a high number of jobs in manufacturing, and older workers who may have had fewer opportunities to retrain or reapply skills when confronted with a new technology and arrangements. This highlights the need for targeted workforce development strategies that address the needs of the most vulnerable populations (Moe & Rodgers, 2024).

Chauhan et al. (2024) further emphasize the ongoing need for upskilling in the AI era, suggesting that continuous learning and adaptability are essential for career longevity and competitiveness. Upskilling encompasses not only technical skills (e.g., programming or data analytics) but also the cultivation of creativity, critical thinking, emotional intelligence, and problem-solving skills. These skills—which are uniquely human—have a lower risk of being replaced by automation. Chauhan et al. (2024) recommend a comprehensive approach to workforce development, including adopting a growth mindset, lifelong learning, and equitable and accessible upskilling. Businesses will need to invest in employee training and foster a culture of innovation, while educational institutions must transform their traditional curricula into courses that are AI- or data-literate. On a similar note, governments will need to support democratizing upskilling and reskilling through AI- and automation-supportive policies.

Innovative workforce development strategies are already being developed to address current and future needs. In their paper, Goel et al. (2024) discuss the National AI Institute for Adult Learning and Online Education (AI-ALOE), which is currently developing AI-powered learning assistants and personalized online education platforms for adult reskilling and upskilling at scale. Digital education and AI assistants proactively mitigate obstacles historically associated with adult learning: access, engagement, and personalization. AI-powered training for a workforce can provide scalable, flexible, and personalized learning pathways for adult learners with diverse backgrounds, interests, and commitments, including those who work, raise a family, or attend to other responsibilities. By offering robust, resilient, and adaptable AI-first reskilling pathways, AI-ALOE aims to address gaps left by America's increased automation in manufacturing. AI-ALOE also emphasizes human-AI collaboration and addresses some of the ethical implications of AI. The organization offers the technical and socio-emotional competencies necessary to succeed in today's fast-paced and ever-changing manufacturing environment (Goel et al., 2024).

Comprehensive upskilling programs also illustrate effective industry practice. For example, programs such as IBM's SkillsBuild, Google's IT Support Professional Certificate, and Singapore's SkillsFuture demonstrate how education, industry, and government institutions can collaborate to create more relevant and democratized learning opportunities within their respective communities. These educational pathways and professional development programs upskill individuals by providing learning opportunities that help workers transition to new careers while also supporting national competitiveness and innovation (Chauhan et al., 2024).

In conclusion, workforce development and skills training are critical for the future of US manufacturing. As manufacturing faces new challenges from automation and AI, a coordinated response that incorporates ideas of lifelong learning, inclusivity, and adaptability is vital. US manufacturing must invest in credible upskilling and reskilling programs to retain a resilient and innovative workforce and remain competitive in a global economy that continues to undergo rapid technological advancements.

Technological Innovation & Advanced Manufacturing

The emergence of new technologies—automation, robotics, AI, and deep learning—is fundamentally changing manufacturing in the United States. These new technologies are revolutionizing the factory floor, enhancing efficiency, quality, and competitiveness. As noted by Wentzky (2020), this has resulted in a dual transformation. Automation and digital tools, primarily robotics and cyber-physical systems, are enhancing productivity while facilitating better decision-making through real-time data. Technologies used in smart factories include interconnected machines that adapt to changing production conditions, adjust output according to demand, and respond rapidly to market changes. However, small and mid-sized companies often lack the capacity to access the technological resources and human capital they need. If automation

and AI technologies are not adopted across the United States manufacturing sector, the gap between technological winners and losers will widen, undermining national efforts to revitalize the manufacturing sector (Wentzky, 2020).

Chukwunweike et al. (2024) specifically document how automation, paired with deep learning, helps to address some of the most significant challenges in manufacturing, such as redundancy, defects, and predictive maintenance. Existing systems can now diagnose machine problems in real time, resulting in less downtime and greater predictability. Deep learning models can be utilized to enhance defect detection and materials testing, resulting in improved quality and compliance. These new technologies offer manufacturers more flexibility, mass customization, and sustainability through waste reduction and improved resource use. Case studies have been shared that outline significant improvements in cycle times, operating costs, and defect rates, including graphical and quantitative data (Chukwunweike et al., 2024).

However, success is not automatic and comes with challenges. Benjamin (2024) notes that specific strategic planning, staggered implementation, and early engagement with operators are necessary for the successful transition to automation. Early failure is often attributed to underestimating the technology's complexity, failing to involve operators appropriately, or being unprepared for the organizational redesign required for large-scale, complex technological change (Benjamin, 2024). All three sources capture the human element, which is vital. As automation and AI continue to improve, education and workforce reskilling become a necessity rather than a mere upskill. The need to navigate resistance to change, address the technical skills gap, and foster an atmosphere of continuous improvement is essential if the manufacturing industry is to advance the prospects of technological innovation.

Conclusion

COVID-19 highlighted weaknesses in American manufacturing and supply chain systems, as well as the need for increased resiliency, domestic production, and strategic investments. For U.S. stakeholders to help revitalize its manufacturing base, they must invest in technology, develop workforce skills, and provide an array of supportive policies. By creating partnerships between the private and public sectors, investing in new and upgraded infrastructure, and providing resources to build regional manufacturing clusters, the United States is poised to establish a more competitive, sustainable, and resilient manufacturing base.

Supply Chain Resilience & Localization

COVID-19 and recent geopolitical disruptions have underscored the fundamental challenges and weaknesses in the US manufacturing supply chain. The widespread unavailability of essential goods, ranging from personal protective equipment to semiconductors, highlighted the risks associated with multi-decade offshoring and dependence on a cost-structured, globally sourced supply chain model (Lovely, 2023). As a result, policymakers and industry leaders are arduously revising supply chain relationships and seeking more resilient, localized, and diversified models.

It is clear from pandemic lessons that supply chains must anticipate and adapt to disruptions. Surveys suggest that 90%+ of manufacturing executives have examined or are working toward reshoring. Because of logistical uncertainty, smaller firms are even more likely to reshore (Stentoft et al., 2024). The implementation of Industry 4.0 technologies—automation, digitalization, and advanced analytics—enables more flexible, productive, and labor-intensive manufacturing practices in the US. However, localization cannot simply mean the repatriation of factories to the US; it requires investing in automation, upskilling the workforce, and creating a more resilient supply chain that anticipates—rather than reacts to—oncoming issues (Akinbolajo, 2022).

Policy interventions play a significant role in this evolving landscape. The CHIPS and Science Act and the Inflation Reduction Act are two pieces of legislation that provide financial incentives to increase spending in critical sectors, including semiconductors, clean energy, and advanced batteries (Lovely, 2023). Relevant aspects of these programs are the “Buy America” provisions, federal support for regional manufacturing centers, and finished and stockpiled US essential goods. Furthermore, hybrid sourcing development may lead to more integrated models in which domestic manufacturing is feasible for managing

high-risk or strategic goods, and nearshoring or friend-shoring is used as lower-priority/complementary sourcing strategies (Akinbolajo, 2022).

The outcomes of real-world scenarios demonstrate the value of pursuing greater resiliency and increased localization/nationalization in supply chains. Research by Akinbolajo (2020) indicates that baseline reshoring could reduce lead time by 61% and reduce the incidence of quality issues. It is also a more responsive model as markets change (Akinbolajo, 2022). Nonetheless, the idea of full self-sufficiency is impractical and unrealistic; instead, a more resilient, adaptable, and regionalized supply chain architecture could potentially be deployed and recognized as essential for economic prosperity (Lovely, 2023; Stentoft et al., 2024). It may be beneficial for national security, particularly in addressing concerns about foreign actors influencing US elections, public opinion, and infrastructure. As the US economy continues to invest in its manufacturing base, resiliency and localization within supply chains will remain core tenets of revitalizing US industrialization. Success means enhanced agility, the security of replacing foreign goods with domestic ones, and paradigm shifts during disasters and critical periods.

Policy & Regulatory Environment

The policy and regulation environment shapes the direction for the US manufacturing's resurgence. The globalization of supply chains requires regulatory clarity and favorable trade policies to support domestic investment and mitigate the risks linked with offshoring (Choi et al., 2023). The COVID-19 pandemic uncovered vulnerabilities in US manufacturing stemming from an over-dependence on foreign suppliers, especially in critical sectors. Therefore, US policymakers have reviewed the US trade agreement, tariffs, and source requirements to promote domestic production while establishing a barrier to deceptive practices.

A primary regulatory tool of the Federal Trade Commission (FTC) is the "Made in USA" standard, which requires that products labeled "Made in USA" be manufactured in the United States, either entirely or virtually. The FTC enforces this requirement by using its power to prevent unfair or deceptive practices, ensuring that claims of US origin are substantiated and not misleading to consumers (FTC, 1998). Thus, the FTC's standard promotes public confidence in domestically produced products, provides a level playing field for domestic manufacturers, and provides manufacturers with a clear framework for compliance when making qualified claims (i.e., that products are assembled in the US or manufactured with domestic and foreign materials). While work still needs to be done to update what are technically outdated policy and regulatory documents, the United States' robust history of manufacturing—which dates to the early 20th century—can assist in policy development. The 'Made in USA' standard—even when positioned as a label on products—continued to resonate with the American public, facilitating a sense of national pride and heritage.

US trade policy significantly influences how companies make their manufacturing decisions. As demonstrated by Choi et al. (2023), there are periods of trade policy uncertainty. For instance, receiving Permanent Normal Trade Relations (PNTR) status from China may cause US companies to outsource polluting or cost-sensitive operations to countries with less stringent regulations. Thus, maintaining a stable regulatory environment and strategically implementing tariffs or incentives are vital to promoting reshoring and domestic investment in cleaner and advanced manufacturing in the United States. A cohesive, forward-thinking policy and regulatory environment—one that combines clearly defined standards, enforcement mechanisms, and trade policies supportive of domestic manufacturing—is required to rebuild a sustainable and competitive manufacturing base. History reveals that the United States is capable of producing the appropriate documentation.

Infrastructure & Energy

A competitive US manufacturing base cannot be realized without an enduring and adaptable infrastructure system. Neglect of the country's infrastructure over the years has led to its deterioration, affecting roadways and bridges, drinking water systems, broadband, and energy delivery systems. These gaps create risks for manufacturers' efficient movement of products and for their access to stable supplies of materials, workforce, and energy (Alliance for American Manufacturing, 2025). Historically funded

through the Infrastructure Investment and Jobs Act (IIJA) of 2021 and augmented by expanded domestic content requirements under the Build America, Buy America Act (BABA), these federal actions provide strong market-based incentives to encourage manufacturers to invest domestically and build robust supply chains. In fact, the maximum utilization of domestically produced materials could increase manufacturing employment opportunities by up to 33% (Alliance for American Manufacturing, 2025). IIJA expenditures are projected to produce approximately 1.8 million manufacturing jobs per year (Alliance for American Manufacturing, 2025). Evidence shows that well-funded and up-to-date infrastructure plays a vital role in enabling manufacturing industries to flourish.

Investments in technology and energy-related infrastructure systems that enable the growth of advanced manufacturing processes will also be critical. The estimated value of reducing the technical gap in the United States in areas such as measurement science, robotics, and automation alone is over \$100 billion in savings for US manufacturers per year (Anderson, 2016). Barriers such as proprietary standards and limited publicly funded research may inhibit innovation and limit the ability of smaller and medium-sized companies to benefit from it. Public-private partnerships, consortia, and technology extension service programs will be essential to ensure that both upgrades to existing infrastructure and the implementation of innovative technologies are available to all manufacturers, not just the larger companies (Anderson, 2016). This will establish a more equitable landscape. To continue making progress, policymakers must ensure that BABA is fully implemented, not weaken the waiver provisions, and continue to upgrade the country's physical and technological infrastructure to power the United States' next generation of manufacturing leadership. BABA still offers a cohesive framework that US manufacturing and industry leaders can use to propel manufacturing.

Financial Investment & Capital Access

To help revitalize US manufacturing, capital is needed; it enables firms to invest in developing new technologies, expanding capacity, and competing internationally. As of late, the federal industrial policy has spurred significant investment in US manufacturing, primarily through large-scale subsidy programs and tax credits in sectors such as semiconductor production and renewable energy (Lincicome, 2024). These policies, including the Inflation Reduction Act and the CHIPS and Science Act, have directed billions of dollars to various industries to spur a manufacturing renaissance. That said, as noted by Lincicome (2024), a sizable portion of this investment was well underway before these policies were enacted. The overall impact of the subsidies also remains unknown.

While there has been an increase in construction and investment announcements for manufacturing projects, the manufacturing sector's overall performance has been mixed. Rising interest rates, continued disruptions in global supply chains, and increased regulatory hurdles have limited many manufacturers' ability to operate profitably. This is especially relevant for small and medium businesses that may have less access to financing than larger entities (Lincicome, 2024). Additionally, Lincicome (2024) notes the potential for government subsidies to create a two-tiered industrial economy, where preferred sectors thrive at the expense of others, potentially leaving them uncompetitive due to limited access to both resources and capital. There are also risks associated with policy-driven investments, including inefficiencies and unintended consequences like overproduction, inefficient resource allocation, and dependence on future government subsidies. To enable long-term growth, Lincicome (2024) suggests that policymakers consider pairing investment incentives with market-oriented reform measures, including lowering tariffs, reducing regulatory burdens through improved permitting processes, and changing tax treatment for capital expenditures to ensure capital flows efficiently across the entire manufacturing industry. Overall, access to capital will be crucial to establishing a strong and durable US manufacturing base.

CROSS-SECTOR COLLABORATION & REGIONAL STRATEGIES

The Role of Cross-Sector Collaboration in Manufacturing Resurgence

A vital force behind innovation and the workforce development needed to rebuild the US manufacturing base is cross-sector collaboration. Collaboration among government, academia, labor, and industry partners

enables companies to share costs, accelerate the development of innovative technologies, and leverage one another's resources. Technology development partnerships, particularly those made between manufacturers and their customers or suppliers, are an essential component of company innovation strategies (Angel, 2002). Collaborations offer companies opportunities to tap external expertise, gain access to new markets, and develop customized products and production processes more effectively than they could on their own. For instance, as noted by Angel (2002), both broader and narrower business relationships among market players (i.e., manufacturing firms, relevant technologies, training, employees, etc.) often also involve technical assistance. The strategic alliances formed among agents enable robust information sharing, both in person and digitally, fostering improved practices, more profound awareness of clients' needs, adaptability, and resilience—components necessary to survive in a challenging 21st-century market where outsourcing has become the norm (Angel, 2002).

The public-private partnership model is especially well-suited to facilitating knowledge flow between sectors. Universities can offer advanced research work and workforce development training, while industry provides practical experience and commercialization routes for product and process innovations. The government's role as an enabler of these partnerships through funding and network facilitation helps remove the obstacles to collaboration and de-risks investments in advanced manufacturing. According to Angel (2002), larger companies in major cities have historically been more likely to form technology partnerships than smaller firms. However, with an effective network of relationships and mutual trust, companies of all sizes can realize the benefits of partnerships. A comprehensive network of actors—all working toward the mutual goal of revitalizing the US's manufacturing sector—can help to restore this so-called 'dying' sector. The government should prioritize an incentive system that promotes domestic manufacturing.

Cross-sector collaboration comprises more than just geographical proximity and sectoral specialization (i.e., that different agents play specialized roles within the overall national system). Successful collaboration requires a culture of information sharing, institutional support, and mutual trust. Policymakers should create environments that foster repeated interactions and shared learning, both within local clusters and across regional and industrial boundaries. As the manufacturing sector adapts to post-pandemic conditions, cross-sector partnerships will be critical to drive technological innovation, build a competitive workforce, and ensure long-term viability for the US manufacturing base. This piece fits in with previous assertions about the need for technological advancement.

Regional Manufacturing Hubs and Cluster Development

The US already has a robust manufacturing network. Regional clusters include automotive manufacturing in the Midwest, electronic components in the Sun Belt, and the revitalization of the former Rust Belt area. All three types of clusters create an environment that is favorable to attracting future capital and encouraging innovation by leveraging established local strengths, supply chains, and talent pools. Regional clusters provide an environment where new technologies can be developed and commercialized faster than anywhere else through collaboration among local manufacturers, universities, research facilities, and local government agencies (Manufacturing USA, 2022).

A region's success depends on its ability to build on its manufacturing history and adapt to the requirements of advanced manufacturing and digital technologies. Manufacturers working in a cluster can share resources, receive specialized training, and collaborate on research activities they could not afford or accomplish alone. In addition, the hubs enable smaller manufacturers to interact with major manufacturers and worldwide suppliers, thereby improving both their resiliency and competitiveness. In this case, there are promising directions if relevant stakeholders from the US—lawmakers, local governors, plant managers, and other figures involved in the manufacturing sector—can meaningfully continue to operate, promote, and upgrade these clusters. This could involve, for instance, large-scale expansion, more integration among systems, and higher financial incentives.

In addition, regional clusters encourage workforce development by providing education and training that align with local industry needs. Many times, this education is delivered in tandem with local community colleges and vocational schools. Therefore, by supporting the development of these hubs, policymakers will ensure that the positive results of a renewed domestic manufacturing base are experienced throughout

America and that the United States can—at least in a preliminary way—regain some footing in the global manufacturing space. Regional cluster development may help prevent large-scale dependence on outsourced materials and products.

Policy Alignment and Stakeholder Coordination

Aligning policies across federal, state, and local levels and coordinating effectively among stakeholders will be needed to deliver a unified response to the resurgence of US manufacturing. Without this type of alignment, there may be redundancy, fragmentation, or failure to capture the total regional and national economic value of clusters and national priorities in the various initiatives undertaken. While Angel (2002) states that inter-firm partnerships and technology development networks are critical to innovation, he notes that the broader policy environment and the infrastructure supporting collaboration influence these networks. Puentes (2011) from the Brookings Institution suggests that PPPs (public-private partnerships) are one way to ensure effective, sound collaboration among industry actors. These are productive partnerships between the government and private entities (e.g., construction companies, universities) that enable the construction of meaningful projects, such as the architecture and infrastructure required for manufacturing. Examples of PPPs can include joint programs between colleges and workforce initiatives (ensuring training meets local needs), transportation and construction contracts, and university-led R&D initiatives. Puentes (2011) notes that bureaucracy and red tape are substantial barriers to completing and initiating projects. PCL Construction (2023) notes, however, that manufacturing opportunities can expand if PPPs—also known as P3s—could be meaningfully established and expanded: a P3 collaborative effort works towards a common, winning goal for everyone. Policies that support and facilitate P3s would certainly help revitalize the US manufacturing sector.

Government agencies, regional economic development organizations, and industry coordination will be critical to maximizing the impact of investment and knowledge sharing. Regional economic development organizations can play an essential role in facilitating this type of coordination by serving as conveners and facilitators of cross-sectoral partnerships. They facilitate tailoring local workforce training, infrastructure investment, and innovation strategies to the needs and strengths of each region. Additionally, regional strategic planning can help avoid duplication of effort, align public and private investments, and assist in creating the “institutional thickness” and trust needed for long-term collaboration (Angel, 2002).

Pro-coordination of national policies established in legitimate, accessible public documents is vital for leveling the playing field and ensuring equity. Effective coordination is critical to ensuring that small- to medium-sized manufacturers receive access to the same policy benefits and participate in the same innovation networks as large manufacturers; otherwise, they may be overpowered. Several reasons for this include that SMEs are often innovative and agile, contributing new ideas and specialized technologies to drive the sector nationally, and that they ensure appropriate market distribution rather than concentration. The overall ecosystem becomes more competitive. In addition, this strengthens local economies (SMEs hire employees in local communities) and enhances the supply chain, making the enterprise and the government much less reliant on outsourcing.

US manufacturing is being shaped by several foundational policies and many policy-related documents that are no longer relevant in today’s highly interconnected, digitally driven, and hyper-globalized economy. The policies developed since 1998 are now significantly influenced by an automated environment, increasingly complex global supply chains, cutting-edge technology, and global competition. These outdated regulations could stifle innovation, create compliance issues, and fail to account for the complexities of modern supply chain vulnerabilities, digital manufacturing, and the need for sustainability and resiliency in today’s post-pandemic world (Holzer, 2022; FTC, 1998). While the US’ “Made in USA” standard, which the FTC created, is an effective strategy, it nevertheless remains somewhat outdated.

The coordination of policies and stakeholders will provide a foundation for developing a resilient and competitive US manufacturing system. This includes establishing and working within PPPs, setting up infrastructure for equitable manufacturing that avoids monopolies, and supporting manufacturing opportunities through well-documented, consistently updated policy.

The Future of US Manufacturing: Trends & Outlook

Lessons from recent disruptions and the potential of technological transformation have shaped manufacturing in the United States. Moving forward, the industry will continue to evolve as the United States recovers from the COVID-19 pandemic and faces ongoing global uncertainty. As a result, several key trends will shape the future of manufacturing, many of them related to the factors explored in this paper.

Firstly, the rapid adoption of advanced technologies, including digital manufacturing, artificial intelligence, and automation, will continue regardless of public opinion. Today, to remain competitive, an organization cannot afford to opt out of Industry 4.0 tools. Future factories and plants will utilize innovative technology, including real-time data, networked machinery, and predictive analytics, to optimize efficiency, reduce waste, and enable mass customization. Examples of this include IoT devices and sensors that monitor product quality, energy usage, and optimal output control. Factories will be able to dramatically reduce downtime thanks to systems that can readily predict customer demand, current supply, and future required supply. In addition, factory personnel—such as supervisors and floor managers—may be replaced by networked machinery that controls systems, coordinates tasks, adjusts schedules, and reroutes workflows. Such strategies will be used for automobiles, consumer electronics, home appliances, industrial machinery, and even apparel and footwear. It will become necessary for manufacturing firms to be informed of the changing technological landscape and to purchase the requisite software and hardware.

Moving forward, the most pressing issue will be upskilling and enhancing the workforce in preparation for change. As AI and automation modify and, in some cases, replace traditional job duties in manufacturing, the industry must focus on providing its workers with opportunities for continuous reskilling and lifelong learning. While technical skills will become increasingly important, creative thinking, independent problem-solving, and the ability to adjust to new and unexpected challenges will also be crucial. It will be necessary for the government, education systems, and businesses to collaborate to create a resilient, inclusive talent pipeline. The talent pipeline should foster and incorporate soft skills, which, according to Sancar and Cavus (2025), can include AI-positive attitudes, AI efficacy, and AI literacy. While empathy and creativity will be necessary, competence in AI will be equally crucial for both manufacturing employees and leaders.

Another feature of manufacturing's next generation will be greater supply chain resilience. The weaknesses of globalized, just-in-time supply chains were exposed during the pandemic, leading to renewed interest in reshoring, nearshoring, and diversification. Supply chains of the future must balance efficiency and flexibility while leveraging digital tools to enhance transparency and adaptability. American businesses can shield themselves from potential disruptions by implementing a more regionalized, robust supply chain architecture. One of the solutions offered in this paper is the regional clusters modality, which is already a strategy taking place in the American Sun Belt and Rust Belt. As noted by Manufacturing USA (2022), these regional clusters draw on several factors: America's existing manufacturing experience and ecosystem, and heritage links to high-quality plants, equipment, and know-how. Furthermore, regional clusters, which effectively link manufacturing initiatives and programs to specific community needs, are self-sustaining and efficient.

An example is medical devices. A distinct example is Minnesota's medical manufacturing partnership, a collaborative program among agencies designed to leverage development funds and accelerate the recovery of nationwide manufacturing (Greater MSP, 2025). The state of Minnesota is a medical device cluster, meaning that it specializes in manufacturing medical devices that meet regional needs. MSF Advanced Technology Education at a notable university collaborates directly with producers and gauges community needs (Greater MSP, 2025). This partnership is a good example of a possible manufacturing solution that could be enacted nationwide in American communities, not just in the Rust and Sun Belts.

Beyond other factors, the industry's policies and regulations will need to evolve. Outdated standards and fragmented rules can stifle innovation and add compliance costs. Thus, manufacturers will need to operate in a regulatory environment that encourages domestic investment, promotes sustainable practices, and supports cross-sectoral and cross-regional collaborations. With the proper set of incentives, streamlined permitting, and modernized "Buy America" provisions, American manufacturers can strategically leverage public policy to achieve a competitive edge. The document "Made in USA Standard" (1998) was published

over two decades ago, before the early 2000s, when globalization began to drastically impact the manufacturing landscape. It will be necessary for government leaders and manufacturing businesses and sectors to collaborate and co-create a new set of standards and rules. The FTC should continue to play a significant role in rebuilding manufacturing, but with an updated policy that incorporates technological advancement, increased diversity, and the critical need for collaborative partnerships across sectors.

Cluster-based strategies and regional industrial hubs may become the rule rather than the exception if America is to pursue its new manufacturing goals. Clusters can be a driver of both innovation and economic development when they leverage local resources, facilitate collaboration, and connect workforce development programs to industry needs. Politicians and business leaders should support the continued creation and expansion of such centers to ensure that everyone benefits from the manufacturing renaissance.

Last but certainly not least, there will be a growing focus on sustainability and the move to renewable energy sources. Increasingly, consumers, investors, and regulators will be applying pressure on manufacturers to adopt circular economy models, reduce their carbon footprint, and invest in clean energy technologies. Those who pioneer in this space will have chances to secure market share and reduce risk. Even though this element was not mentioned in the paper—or was mentioned only briefly—it is vital, given that shareholders, stakeholders, and customers expect manufacturers to consider environmental concerns and sustainability. An example of this is EV manufacturing (Bird et al., 2025), with American-based companies—for instance, Tesla—paving the path for a new sustainable future.

RECOMMENDATIONS & STRATEGIC PATHWAYS

Rebuilding American manufacturing requires a cohesive, flexible strategy to address long-standing problems while creating substantial new opportunities for manufacturing in this country. First, government officials and relevant leaders need to update an antiquated regulatory structure to align with the existing state of global, technologically based manufacturing. Second, there is an urgency to invest in innovative technologies, workforce training, and infrastructure to build manufacturing capacity in the country. This could involve active investment in and promotion of specific AI skills training programs that meet Industry 4.0 standards. The ideal situation would include training employers in manufacturing to convey AI-based skills to their employees. A robust, feedback-based system with a centralized information hub and resources would be ideal.

In addition to these areas, policymakers need to support the thousands of small- and medium-sized manufacturing companies in the country so they can participate in innovation networks and receive government benefits and support. Focusing on building regional clusters around common themes or industries will enable communities to develop their own unique regional strengths, promote cross-industry collaboration, and establish sustainable systems that link education, research, and business. No doubt, this will involve conducting comprehensive state-level analyses of each state's needs and tailoring manufacturing solutions accordingly.

Public-private partnerships and coordination among stakeholders at every level of government will be necessary to maximize the effectiveness of investments and the sharing of information on improving the manufacturing process. Supply chain resiliency and sustainability must remain a priority, along with incentives for businesses to reshore manufacturing and produce products domestically. While it is not a necessary component—at least not yet—there should be incentives offered for clean energy production solutions. The United States can create an ecosystem that enables manufacturers of all sizes to compete, innovate, and succeed. By coordinating US policy, investment, and regional strategies, America can restore its manufacturing base as a significant source of economic growth, national security, and shared prosperity and ensure it remains a leading manufacturing competitor into the future.

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