



The 'Productivity Paradox' of AI Adoption in Manufacturing

Organizations typically view artificial intelligence as a way to achieve productivity gains. But research by Kristina McElheran, a digital fellow at the MIT Initiative on the Digital Economy, and others reveals that introducing AI in U.S. manufacturing firms often leads to a temporary decline in performance followed by stronger growth. Here's what the research shows about the adoption and application of AI, and the types of firms that outperform others in using new technology.

1. AI adoption initially reduces productivity.

Even after controlling for size, age, capital stock, and IT infrastructure, the researchers found that **organizations that adopted AI for business functions saw a drop in productivity of 1.33 percentage points.**

This decline points to a deeper misalignment between new digital tools and legacy operational processes, the researchers found. **AI systems used for predictive maintenance, quality control, or demand forecasting often also require investments in data infrastructure, staff training, and workflow redesign.** Without those pieces in place, even the most advanced technologies can underdeliver or create new bottlenecks.

2. Short-term losses precede long-term gains.

Despite early losses, the study found a clear pattern of eventual improvement. Over a longer period of time, manufacturing firms that adopted AI tended to outperform their non-adopting peers in both productivity and market share.

But that upswing wasn't distributed evenly. **The firms seeing the strongest gains tended to be those that were already digitally mature before adopting AI.**

"Firms that have already done the digital transformation or were digital from the get-go have a much easier ride because past data can be a good predictor of future outcomes," McElheran said. Size helps too. "Once you solve those adjustment costs, if you can scale the benefits across more output, more markets, and more customers, you're going to get on the upswing of the J-curve a lot faster," she said.

3. Older firms see greater short-term losses.

The negative impact of AI adoption was most pronounced among established firms. These firms often have trouble adapting, partly due to institutional inertia and the complexity of their operations.

In contrast, younger, more flexible companies appear better equipped to integrate AI technologies quickly and with less disruption. They may also have less to unlearn, making the transition to AI-enabled workflows more seamless.

The researchers also note that their results show the importance of complementary practices and strategies that boost long-term returns to realize AI's longer-term productivity at scale.