

EACH INDUSTRIAL REVOLUTION has transformed production, delivered better economic output, and, consequently, immense economic gains globally. But something has shifted in the past two decades—manufacturing productivity growth appears stuck. In spite of the continual improvements in equipment, software, and management approaches, the annual labor productivity growth rate in the United States was around 0.7 percent in the years between 2007 and 2018, and showed **zero net average growth** during the past five years.

Labor productivity is a major metric of economic output, and gains in productivity are important because, on a macro scale, labor productivity determines the standard of living of people, nations, and the world.¹ Currently, however, economic output is moving in lockstep with the number of hours people work, rather than rising as it did for much of the last seven decades (figure 1).²

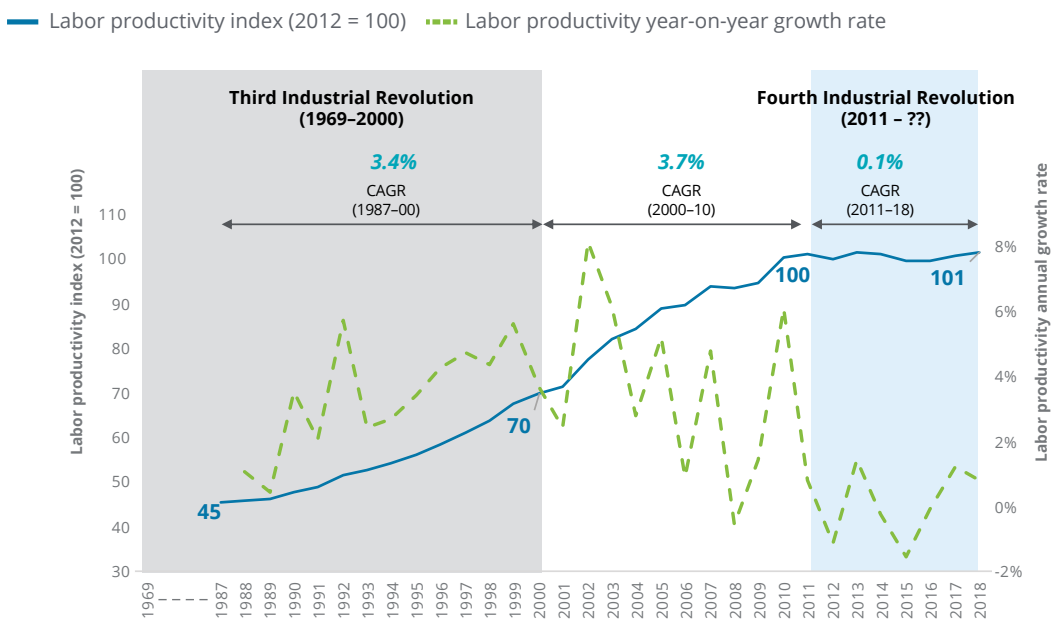
Enter the Fourth Industrial Revolution—the newest chapter in industrial development that promises to ignite stalled labor productivity in manufacturing via connected machines, people, data, and value chains. In that sense, **the smart factory could potentially ignite stalled labor productivity and unlock the key to productivity for manufacturers.** But how? In April 2019, Deloitte and the Manufacturer’s Alliance for Productivity and Innovation (MAPI) jointly launched a study to determine how manufacturers are pursuing smart factory initiatives to drive business impact (see sidebar, “Research methodology”). Qualitative and quantitative analysis reveals five major findings:

- Every manufacturer—whether already “running smart” or yet to invest in smart factory technologies—can harvest business value from smart factory initiatives.

FIGURE 1

US manufacturing labor productivity appears stalled, compared with gains from last technology-based industrial revolution

Manufacturing labor productivity, 1969-present (2012 index = 100)



Sources: Data from Bureau of Labor Statistics, Deloitte and MAPI Smart Factory Survey, and Deloitte Analysis.

- Smart factory initiatives accelerate business value creation. Companies report as much as 10–12 percent gains in areas like manufacturing output, factory utilization, and labor productivity after they invested in smart factory initiatives.
- There is a direct and established connection—primarily through investment and use cases—between smart factory initiatives and the business value realized. What’s more, any manufacturer can use this connection.
- While there are risks, primarily operational and financial, they are outnumbered by the smart factory’s value contribution. Also, most risks can be mitigated through rational stakeholder selection, an efficient change management strategy, measurable proof-of-concepts, and incremental investments.
- An identified cohort—we call it Trailblazers—is outperforming with smart factory initiatives.

Early smart factory adopters report average three-year gains of 10 percent for factory output, factory capacity utilization, and labor productivity. Not just that, these companies expect labor productivity to improve another 2 percentage points to 12 percent by 2022 (figure 2).

A closer look at labor productivity trends indicates that smart factory initiatives will likely enable the US manufacturers to “observe” triple the labor productivity growth rate during the next decade (2019–2030) compared to last decade (2007–2018).

Using the study data and our forecasting model, we determine that **labor productivity will likely grow at a compound annual rate of 2.3 percent during 2025–2030**, closer to the level last seen in the 1990s (figure 3).

What does this mean for manufacturers?

The promise of improved labor productivity is certainly enticing for manufacturing, as the industry sits in the midst of a labor shortage that is on the brink of becoming a drag on productivity.³ Technology can spur new levels of productivity throughout the factory as companies combine technologies (such as vision systems, harmonic sensors and cobots with cognitive computing, machine learning, and autonomous capabilities. Each industrial revolution has seen this curve). Significant labor productivity gains manifest toward the end of the cycle, reflecting the cumulative impact of

FIGURE 2

Benefits from smart factory initiatives are many and sizeable

Impact to the key manufacturing metrics over the past three years



+12%

Change in labor productivity



+11%

Change in factory capacity utilization



+10%

Change in total production output

Source: Deloitte analysis of the 2019 Deloitte and MAPI Smart Factory Study data.

RESEARCH METHODOLOGY

Deloitte and MAPI jointly launched a study in April 2019 to quantify the impact of smart factories on US manufacturing productivity and manufacturing’s contribution to the US GDP through 2030. The study included an online survey of more than 600 executives at manufacturing companies with headquarters in the United States and a global factory footprint, interviews with more than a dozen executives from manufacturing companies, and focus group discussions with finance and operations leaders at manufacturing companies. Additionally, we analyzed secondary data and used economic projections from Deloitte’s global economic team. To calculate the manufacturing labor productivity index and manufacturing labor productivity growth rate during 2019–2030, we used Oxford Economics’ Global Economic Model, data from the Bureau of Labor Statistics, and responses from the 2019 Deloitte and MAPI Smart Factory Executive Survey (figure 1).

Additionally, we classified the adoption of smart factories into two phases—phase 1 (2019–2024) that will likely experience relatively slower adoption and phase 2 (2025–2030) that will likely experience accelerated adoption. Based on the level of smart factory adoption reported by the respondents, we classified the sample into two segments: Traditional manufacturers (no ongoing smart factory initiatives; 49 percent of the sample) and manufacturers with smart factory initiatives (some form of ongoing smart factory initiatives; 51 percent of the sample).

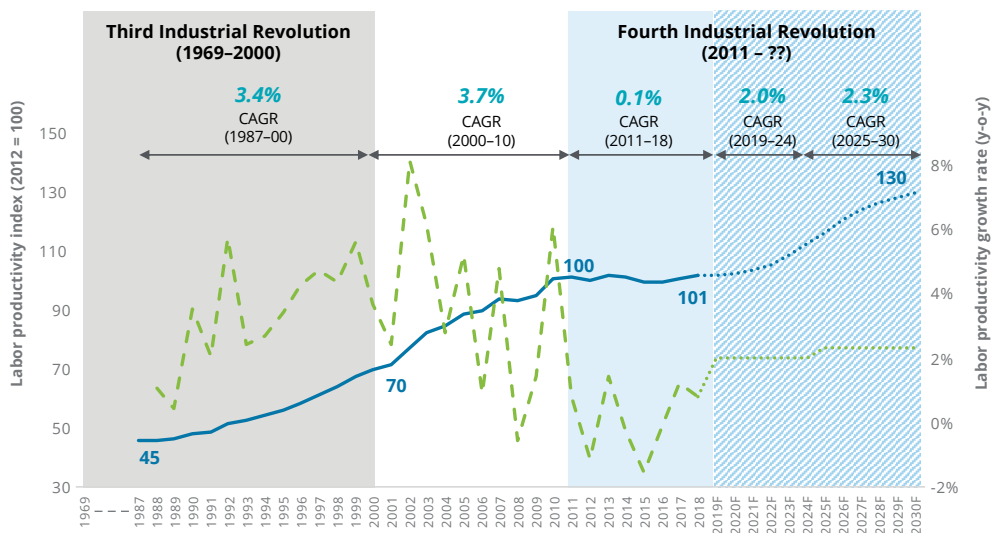
We have described the research design and methodology in more detail in the main article, [2019 Deloitte and MAPI Smart Factory Study: Capturing value through the digital journey](#).

FIGURE 3

Smart factory initiatives that are part of fourth industrial revolution could ignite labor productivity growth

Manufacturing labor productivity, forecast, 1987-2030 (2012 index = 100)

— Labor productivity index (2012 = 100) - - - Labor productivity year-on-year growth rate



Sources: Data from Bureau of Labor Statistics, Deloitte and MAPI Smart Factory Survey, and Deloitte Analysis.

reaching a critical mass of technology adoption. The study identified 12 common categories of use cases—each a combination of advanced technologies targeted at specific business and production processes in smart factories—and our analysis reveals that the majority of manufacturers actively investing in smart factory have an average of nine use cases currently in action.

Trailblazers lead the way

Another key finding of the study is that there are *three distinct cohorts of adopters of smart factory*

initiatives. We call them **Trailblazers**, **Explorers**, and **Followers** (figure 4). Each cohort represents a different approach toward smart factory adoption. Where activity, maturity, and outcomes are concerned, Trailblazers are leading the way. In fact, this group has seen **twice the level of gains** to labor productivity compared with Explorers and Followers combined. Furthermore, Trailblazers expect increases in labor productivity to continue to accelerate ahead of the average over the next three years. Clearly, Trailblazers have determined the formula for extracting value through investments in smart factory initiatives.

FIGURE 4

A deep dive into the traits of Trailblazers, Explorers, and Followers

The 2019 Deloitte MAPI Smart Factory Study identifies three distinct cohorts of adopters—Trailblazers, Explorers, and Followers—each representing a different mindset toward smart factory adoption, and determines how their mindset and decisions influence their maturity in smart factory initiatives.

COHORTS WE IDENTIFIED			
	TRAILBLAZERS	EXPLORERS	FOLLOWERS
Proportion	18%	55%	27%
Maturity level	<i>Moving toward complete transformation of at least one factory</i>	<i>Currently implementing initiatives related to smart factory</i>	<i>On the smart factory journey</i>
Budget share	65%	19%	13%
Use case in action	More than 10	More than 9	More than 5
Benefits observed*	20%	10%	8%

Parameters we identified: Approach toward smart factory initiatives; share of smart factory budget; number of ongoing use cases; benefits seen over the last 3 years.

** Average reported changes: Change in production output, factory capacity utilization, and employee productivity from smart factory initiatives in the last 3 years.*

FIGURE 4 *continues*

THREE COHORTS—TRAILBLAZERS, EXPLORERS, AND FOLLOWERS—EACH REPRESENTING A DIFFERENT MINDSET TOWARD SMART FACTORY ADOPTION

TRAILBLAZERS: Pioneering the adoption of smart factory initiatives

When it comes to factory-related innovation, Trailblazers are “the first to innovate.” They have identified the potential value that smart factory can deliver and have stepped up to invest in that potential.



INVESTMENTS

On average, Trailblazers dedicate a whopping 65 percent of their global factory budget to smart factory initiatives.



USE CASES

Trailblazers invest in multiple initiatives; on average, they have more than 10 use cases at a given time.



ADOPTION LEVEL

Trailblazers are transforming at least one facility into a smart factory. They are 3X as likely to be transforming the entire factory footprint than others.



BENEFITS OBSERVED

Between 2015 and 2018, Trailblazers’ smart factory initiatives led to twice the benefits than others.

Ecosystem—Trailblazers connect up and down their value chains, from inside (engineering) out to suppliers and customers, indicating they understand the importance of a connected ecosystem to succeed in their smart factory initiatives.



EXPLORERS: Navigating new territories and charting a course

Like Trailblazers, Explorers are well underway with their smart factory initiatives, but they have adopted a “moderated approach” toward investment and use cases. In terms of adoption, most Explorers seem to “be a leader, but not the first.” While they are cautious and take small smart factory initiatives, they have begun to see some benefits.



INVESTMENTS

On average, Explorers dedicate 19 percent of their global factory budget to smart factory initiatives. What’s more, 64 percent of Explorers report average potential increase of 12 percent in the coming year.



USE CASES

Explorers’ lower budget allocation yields fewer than 10 use cases, but these investments are still spread across all 12 categories.



ADOPTION LEVEL

Explorers exhibit a lower adoption level, with the majority currently implementing initiatives at the single asset or production line.



BENEFITS OBSERVED

The steady progress of Explorers has delivered measurable benefits—factory capacity utilization and employee productivity have increased, both by 10 percent on average during the past three years.

Ecosystem—Explorers are connecting with their ecosystem for smart factory initiatives, albeit at a slower pace than Trailblazers.

FOLLOWERS: On the smart factory journey

Followers have an overwhelming characteristic of “waiting until technology is proven.” While caution can be a worthy attribute in some cases, in this age of digital transformation, it can be a severe impediment. Followers are behind their peers, but it is not too late to ramp up activity and catch up quickly.



INVESTMENTS

On average, Followers dedicate only 13 percent of their global factory budget for smart factory initiatives, but 59 percent hope to increase investment in the coming year by 11 percent on average.



USE CASES

Followers’ lower investment yields fewer use cases—five on average. But these cases are generally spread across all 12 categories.



ADOPTION LEVEL

Followers’ smart factory initiatives are often at the “planning to start implementing” stage.



BENEFITS OBSERVED

Followers saw modest gains in key productivity metrics, but they do expect this to increase by 3 percent in the coming three years.

Ecosystem—Followers fall behind peers in connecting their ecosystem; on average, 20 percent have connected ecosystems. Glaringly, 27 percent are connected to “nobody other than production”—this is a potential opportunity for Followers to leverage.

Source: Deloitte analysis of the 2019 Deloitte and MAPI Smart Factory Study data.

Final thoughts

Whether manufacturers are just starting on their smart factory journey or well along the pathway like Trailblazers, there's no doubt that smart factory initiatives could have a significant impact on manufacturing productivity. Naturally, there are caveats. There is also a need to launch these initiatives properly to set a team up for success. When and how smart factory use cases are launched can determine their success. In the *2019 Deloitte and MAPI Smart Factory Study: Capturing value through the digital journey*, we offer a deeper dive

into some of the best practices for adopting smart factory initiatives, further insights into how Trailblazers are pushing the envelope, and 10 common approaches to smart factory adoption that can be part of manufacturers' "playbook" for getting started.

Read the full report, *2019 Deloitte and MAPI Smart Factory Study: Capturing value through the digital journey*, for more.

Endnotes

1. Bill Conerly, "Productivity and economic growth," *Forbes*, May 19, 2015.
2. Neil Irwin, "Why Is productivity so weak? Three theories," *New York Times*, April 29, 2016.
3. Craig Giffi et al., *2018 Deloitte and The Manufacturing Institute skills gap and future of work study*, Deloitte Insights and The Manufacturing Institute, accessed August 22, 2019.

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Editorial: Kavita Saini, Rupesh Bhat, Nairita Gangopadhyay, and Preetha Devan

Creative: Anoop K R and Rajesh Venkataraju

Promotion: Nikita Garia

Cover artwork: Kevin Weier

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