IBM Institute for Business Value

Why cognitive manufacturing matters in electronics

Activating the next generation of production success

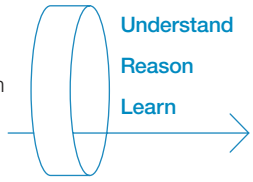
Overview

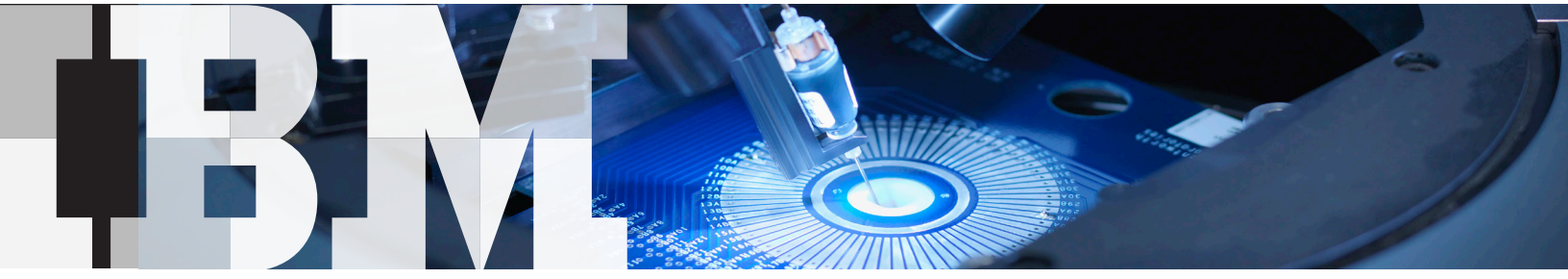
Electronics manufacturing is surrounded by continuous complexity. Executives face rising resource costs in traditionally low-cost production markets. They must address increasing customization, shorter lead times, frequent changes of requirements, shrinking order sizes – all while managing a sophisticated supply network. They need to examine automation potential and maintain critical institutional knowledge. Yet, thinner margins and increased competition threaten consistent quality, high uptime and desired flexibility. At the same time, investments in new equipment and automation systems are increasing the amount of data available from the shop floor, most of which is not used to its full potential. In the face of this complexity, cognitive manufacturing is transforming the production landscape. These new systems address complex manufacturing issues, integrating cyber and physical systems for optimal output, interpreting data for value identification and realization.

Cognitive computing represents an emerging technology that increases productivity, yield and quality while continuously learning, improving employee actions, processes and outcomes. When combined with manufacturing technologies, it results in cognitive manufacturing (see Figure 1). It unites millions of data points into a source that discovers patterns and answers questions across the plant, including users, equipment, locations and streaming sensor data. Cognitive manufacturing harnesses natural language and sensory-based capabilities. Cognitive manufacturing leverages current production technologies, such as the Industrial Internet of Things (IIoT), analytics, mobility, collaboration and robotics to provide tangible benefits at the plant level.

Cognitive manufacturing creates new interactions between humans and machines. It enables a machine supervisor to assess the performance of a process or machine and receive immediate answers, preventing unplanned downtime. It allows machine technicians to access years of

Figure 1: Defining Cognitive Computing and Cognitive Manufacturing





stored performance insight, quality assessments, manuals and repair detail, presented in context with user needs. It addresses a potential critical parts shortage by providing supplier/ecosystem detail, weather and transportation information and company expertise, all in a shared resolution room.

To understand how the Electronics Industry is applying cognitive manufacturing, the IBM Institute for Business Value surveyed 140 electronics executives around the world. We found some manufacturers have flipped the switch to cognitive manufacturing, showing greater return on investment (ROI) with increased productivity. We found:

- A set of baseline capabilities to embrace cognitive manufacturing based on current technologies – the "cognitively capable"
- Three stages of cognitive manufacturing maturity: Actives, Starters and Observers
- Obstacles and barriers aligned to an organization's cognitive manufacturing maturity.

Identifying the cognitively capable

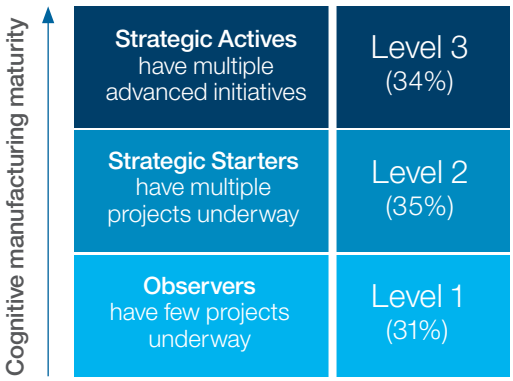
Adoption of cognitive computing is emerging: only 7 percent of study participants are in broad rollout across the industry. However, another 50 percent are in limited rollout or pilot. Our research shows broad adoption of cognitive technologies in electronics is nearly double that of other industries. Yet many more manufacturers are ready for cognitive.

Cognitively capable organizations actively use advanced analytics. This might include predictive analytics or big data approaches. A majority of respondents are actively pursuing these areas – over three-quarters were piloting or in stages of rollout. The cognitively capable also use IoT or sensor data in the manufacturing environment. More than 70 percent of respondents had IIoT efforts underway. When an electronics manufacturer develops these two competencies, it is cognitively capable. More than 65 percent of our respondents fall into this category.

Three stages of maturity

Being cognitively capable is just the start; developing expertise is what drives cognitive manufacturing value. To do so, an electronics company must have a defined cognitive manufacturing strategy and a portfolio of strategically aligned technology implementations. Companies with a strategy significantly outperform those without one. Companies that have both a strategy and implementations see better ROI for each technology. Our analysis shows that an overarching strategy effectively queues the technologies for greater success.

Actives show greater ROI success on their technology projects. They also show markedly fewer failed projects. The other groups, Starters and Observers, show some high ROI projects, but lack the sustained benefits aligned to a complete strategic vision.



Industry contacts

Bruce A. Anderson
Global Managing Director
Electronics Industry
baanders@us.ibm.com

Cristene Gonzalez-Wertz
Electronics Industry Lead
IBM Institute for Business Value
cristeneg@us.ibm.com

John Constantopoulos
Director, Cognitive Electronics
joconst@au1.ibm.com

Qin XK Deng
Director, Electronics Industry
dengdqdq@cn.ibm.com

Actives pursued a specific technology path, focusing first on cloud computing and IIoT upfront (sensoring), then looking to analytics – both predictive and big data. This path moves Actives toward more autonomous and self-learning systems. They expect to continue cognitive manufacturing investments, based on ROI and results that deliver more transparent processes and better insights.

Obstacles and barriers to cognitive manufacturers

We examined how electronics companies prepare for cognitive manufacturing, including initiatives and barriers to overcome. Many respondents considered process re-engineering as a precursor. However, Actives understand processes should be redesigned simultaneously with cognitive manufacturing projects. As expected, each of the cohorts coalesced around barriers aligned to their cognitive manufacturing maturity.

	Barriers
Observers	44 percent cited challenges with the business case 34 percent noted a lack of tools
Starters	37 percent were concerned about their data quality
Actives	59 percent noted a need for the right resources for cognitive manufacturing

Business case and strategy go hand in glove, explaining why Observers are less mature. Data quality is a common hurdle for companies starting toward IIoT and digitized operations. Actives have cleared these preliminary hurdles and now focus on cognitive manufacturing sustainability, including new partnerships between human resources and production machines.

Recommendations for electronics manufacturers

Our research includes recommendations for Actives, Starters and Observers. We also added strategy outlines, use-case templates and industry benchmarks for business-case preparation:

Actives	- Validate investment returns and tech portfolio - Procure talent while others are still preparing - Combine analytics, automation and cognitive.
Starters	- Examine current and planned investments - Address data quality and governance - Go beyond the technologies to specific use cases.
Observers	- Complete your strategy first - Ensure you're "cognitive capable" - Focus on gateway use cases: quality and maintenance.

It is possible for observers to catch up if they are cognitively capable by pursing projects in predictive and/or big data analytics and with investments in IIoT. If executive teams are committed, they can use the next 12-15-months for accelerated efforts to move into the Active category – flipping the switch toward better metrics, knowledge improvement and cognitive manufacturing.

How IBM can help

IBM has a unique position in the marketplace, offering cognitive platforms and services, industry-specific offerings and expert consulting to support electronics companies. We engage clients in identifying cognitive manufacturing entry points that move beyond cost cutting to transforming production with capabilities that include:

- Business and technology strategy consulting services to define a client's cognitive manufacturing strategy and use cases to deliver business value through technology
- Watson accelerators and services that allow quick-starts to key cognitive manufacturing use cases in visual inspection and quality, maintenance and plant-level IoT
- A best-in-class platform for enterprise search for trend-spotting and deep discovery
- Consulting, design, and implementation approaches that support new interaction and business models that make cognitive manufacturing more affordable and extensible.

IBM Global Services
Route 100
Somers, NY 10589
U.S.A.

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