



LEAN AI: 'MARRYING' ARTIFICIAL INTELLIGENCE AND LEAN MANAGEMENT IN MANUFACTURING

IF YOU THINK ARTIFICIAL INTELLIGENCE (AI) IS THE KEY TO YOUR COMPANY'S DIGITAL TRANSFORMATION, YOU'RE MISSING A FEW PIECES OF THE PUZZLE.

AI allows greater connectivity between people, information, and machines, improving how manufacturers optimize products and processes. Just as manufacturers have benefited from lean management principles, ai promises to be the next evolutionary step in productivity advancement.

Already, 92% of senior manufacturing executives believe that 'Smart Factory' digital technologies like AI will help them increase their productivity levels and empower staff to work smarter, according to The Manufacturer's 2018 Annual Manufacturing Report.

But just as AI will improve how workers interface with technologies, advances in AI will make human involvement in many manufacturing processes redundant. In fact, Pragmatic AI — the practical application of artificial intelligence to specific tasks and business processes — eliminates the need for human involvement in advanced cases, where machines' speed and performance are superior to those of humans. According to Jamie Hall, senior solutions specialist at Microsoft:

"[As manufacturers] combine the data collected from connected devices with rapidly advancing Artificial Intelligence to enable 'smart machines'... these will, in turn, simulate intelligent behavior with little or no human intervention."

Through self-learning, AI will improve the quality, lead time, and costs associated with product development, changing the face of workforce management entirely. So, where does that leave your people?

As a technology, AI's principal role is as an agent of continuous optimization — much as continuous improvement and a commitment to change are tenets of a Lean philosophy. That's why it's essential that stakeholders incorporate Lean principles as they offset some traditional roles of humans while integrating AI.

Already, the use of AI can reduce producers' conversion costs by up to 20%, with up to 70% of the cost reduction resulting from higher workforce productivity. Combining AI with Lean will allow manufacturers to create a new company culture, ensuring not only better operations but a more adaptable workflow for employees as they cede certain responsibilities and transition into new ones.

HOW WILL THE MARRIAGE OF LEAN AND AI IMPROVE MANUFACTURING?

"Just as the introduction of Lean Management has driven profound cultural changes in corporate culture, the introduction of AI in manufacturing processes requires its own cultural adaptation to which Lean Management must play a critical role."

Patrick Wiebusch, Co-founder & Managing Partner, Four Principles

In many cases, Pragmatic AI is narrow in its scope, playing a supportive role to human experts who use its analyses to improve decision-making processes. However it will soon graduate from its 'assisted intelligence' role to become autonomous and AI will increasingly make its own decisions on which business leaders can rely.

Since there are already dozens of pragmatic AI applications across manufacturing verticals, it's transition to autonomy will transform all areas of the enterprise. But Lean principles capture the value of Pragmatic AI as companies improve upon dozens of manual business functions — whether its analyzing IoT sensor data, predicting equipment failure, or optimizing inefficiencies in the supply chain.

HOW WILL LEAN MANAGEMENT SUPPORT THIS TRANSITION?

With all this talk about human redundancies, don't lose sight of the fact that your people still matter — a lot. Companies that want to take a Lean approach to AI must start by aligning expectations across all teams that interact with new AI solutions. With their expectations aligned, they can use Lean processes to tackle the biggest risks associated with AI, i.e. misalignment of goals and disengagement of the workforce, during the early-stage implementation process.

The Lean approach is not linear — it requires iterative data modeling and consistent user feedback as the implementation process unfolds. Sometimes that feedback will require Lean managers to reset their approach to adoption, which is part of the Lean process. This is critical to delivering a successful end result that directly addresses business needs.

After implementation, teams must learn to continue using the Lean AI process not only for future projects. But for day-to-day continuous improvement efforts. Ultimately, Lean AI will be able to design processes by extracting Lean principles as needed, removing companies' dependencies on human involvement to do so.

That's why Lean AI requires a significant, coordinated effort across diverse teams — many of which are siloed in organizations — including stakeholders, data scientists, and professionals working on the factory floor. Lean Management principles are essential as these teams integrate Lean AI into their company culture. As we will find, companies that have successfully 'married' AI and Lean management have realized substantial benefits in adding value for customers, reducing waste, improving the quality of products and services, and accelerating service delivery.

HOW LEAN HELPS AI AND VICE VERSA

"Eliminating waste and improving efficiencies is as much a principle of AI as it is of Lean Management. Companies that want to align teams with new AI modalities can leverage Lean principles as they take that next evolutionary step."

Ernest Nedic, Director Kaizen Lab, Four Principles

Today's Lean management systems drive the front-line staff experience, converting deep organizational knowledge into practical behavior and business value. Lean management and AI have the potential for innovation as company leaders incorporate staff experience into the development of new roles and technology structures. Even as AI reduces companies' dependence on human processes, failure to involve staff in AI initiatives may undermine its potential benefits.

Consider Lean Management as it stands today. It is a method that depends on interventions, whereby work is halted to solve a problem or improve a process. Team members observe and analyze before taking action and restarting work. It's this dedication to constant improvement that has made Lean so successful.

Unlike this 'start-and-stop' process which humans must carry out to make Lean improvements, AI can conduct its observations, analyses, and resolutions without slowing or sacrificing production value. What's more, AI improves the ways in which it resolves problems as time goes on. Manufacturers can apply AI in this way at any scale. This will increasingly become standard as the industry evolves.

TECHNOLOGIES STILL WORK FOR PEOPLE — NOT THE OTHER WAY AROUND

Fortunately for human beings, they're still in high demand. Nearly half of all manufacturers (47%) expect the number of employees dedicated to AI to increase in the years ahead. As a result, business leaders must overcome key challenges in how they manage their workforce. Key strategies for adaptation include:

- *Incorporating staff knowledge during implementation* — As manufacturers consider applications for AI, they must take a holistic approach to understanding staff experiences and clearly define which of their responsibilities AI will adopt. In this way, implementation lends itself to Lean processes empowered by AI-cognizant workers, who will benefit from problem-solving capabilities provided by AI while on the job
- *Plan for future skillset deemed mandatory to succeed using AI* — The era of AI is overturning work as we know it. And as companies start using intelligent technologies thoroughly, many people who have been well-trained for their positions for a long time may suddenly find themselves in uncharted waters. The good news is that employees are ready to embrace the changes they foresee coming. Studies show that over 60% of workers have a positive outlook of the impact of AI on their work and are ready to embrace the idea of acquiring required new skillset to adapt to this technological change. Large companies, however, are not on the same page as their employees. For one thing, business leaders believe that only 25% of their workforce is prepared to adopt AI. Yet only 3% of business leaders are planning significant increases in their training budgets to meet the skills challenge posed by AI
- *Adapting production processes with evolving algorithms and data* — Manufacturers must increasingly become 'digital companies' if they are to leverage data as a central part of their business. Unlike traditional, static technologies that retain the same functions indefinitely, AI algorithms evolve alongside data that is changing in real time. AI needs constant input and analysis as the forms of data changes — whether numeric, relational, or narrative — aligning the benefits of AI technologies with operational value

There are applications for AI that are accessible for most manufacturers. Studies suggest that over the last two years 80% of manufacturers who had adopted AI realized a moderate (23%) or significant (57%) value increase. Many of these companies have latent IT and OT data assets and are already harvesting data from IoT sensors, which AI can leverage to optimize processes and business results.

REAL-WORLD APPLICATIONS AND BENEFITS

Now, AI is quickly becoming the determining competitive factor among manufacturers. Manufacturers of all sizes report improving results across major areas of operations, including production (37%), quality (25%), and logistics (12%), among others. These companies are responding to increasing demands from their customers for shorter lead times, quality improvements, and tailored solutions as they carry out these technology changes.

Manufacturers must achieve the right perspective on these challenges and adopt Lean principles to integrate AI successfully. The following three Use Cases exemplify how manufactures can execute AI as part of this approach.

Use Case 1: Industrial robotics manufacturer uses deep reinforcement learning to improve connectivity and AI usage in equipment

A leader in industrial robotics manufacturing wanted to implement an industrial AI platform that would improve connectivity between employees and equipment. The company integrated deep learning into its robots, enabling them to train themselves on repetitive tasks in a collaborative way. By reducing a multiple-hour task with one robot to a one-hour task employing multiple AI-enabled robots, the company achieved less downtime, a greater capacity for varied tasks, and ever-improving accuracy in project execution.

Use Case 2: Multi-national food and beverage manufacturer achieves value-generating transformation with combined AI and Lean management approach

Due to siloed operations, the company suffered from low visibility into order fulfillment operations, causing revenue loss, overpayments, and compliance issues. Their dependence on manual processes jeopardized account management and extended lead times. A combination of new digital technologies and a Lean Management approach supported process transformation and resolved these problems; it also created a \$185 million increase in projected business over six years through cost savings, increased efficiencies, and risk prevention.

Use Case 3: Semiconductor manufacturer achieves 30% reduction in scrap rates, optimized fabrication with machine learning

Using AI-driven root-cause analysis and testing solutions, a global semiconductor manufacturer reduced testing costs and enhanced predictive maintenance of its industrial equipment. Running manufacturing equipment on machine learning algorithms also helped the company reduce downtime; annual maintenance costs; and the cost and frequency of equipment inspections.

THE FUTURE OF LEAN AI

AI is an incredibly powerful technology category with hundreds of applications. Still, encouraging AI adoption while eliminating human redundancies is a complex process – especially in large organizations with multiple stakeholders across departments.

“A Lean approach to AI adoption harnesses the strengths of people themselves – leaders, data teams, and team members on the factory floor – delivering results in a faster and more consistent way. Companies that are leading their industry with AI are usually leveraging the technology to deliver business value while successfully transitioning employees away from redundant processes.”

Stefano Gaspari, Principal, Four Principles

Using AI to augment human capabilities maximizes human potential to create value sustainably, meaning that when AI is implemented interchangeably with human contribution it results in elevated human intelligence that offers a competitive advantage generating tangible business results much faster than having either in place independently. Thanks to easier stakeholder buy-in, quantifiable ROIs, lower R&D costs, fewer technological hurdles, and less change management, AI is being used not only to improve mechanical and technical processes, but with its introduction, to augment human jobs by introducing new skillsets in understanding it and maneuvering it...

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