AI, MANUFACTURING, AND THE NEXT BIG STEP IN OPERATIONAL EFFICIENCY

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AICC AI White Paper 1

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Introduction

Less than 80 years ago, producing a single corrugated box required the effort of several individuals and took several minutes. Today, thanks to high speed flexo machines, a printed and slotted box takes less than 200 milliseconds, showcasing a remarkable leap in efficiency and quality.

Initially, automation focused on streamlining box manufacturing itself. Now, for the first time, we possess tangible technology capable of automating entire box plant operations. This is the promise of AI: leveraging existing structures to propel businesses further. It represents the natural evolution in the industry. The power of Artificial Intelligence is harnessed through the electromechanical and software technology already in place. Whether it's the latest converting machines, corrugators, conveyors, robots, or the software integral in managing operations today, they collectively form the solid foundation on which AI builds and evolves.

Is Artificial Intelligence for box plants and corrugated? Yes. The struggles we have today in our industry around labor shortages, skill gaps, supply chains, and global competition are universal. Other industries have more market pressure to become early adopters like automotive and financial services, but the solutions they produce will apply to us as well.

Is now the right time? Yes. For 2 reasons: It will not be cost-prohibitive given the value it offers. What this means is that the combination of

investing in IoT (which includes sensors and connectivity options) and AI, as well as the decreasing costs and widespread availability of cloud computing resources, has made it much more feasible and affordable for small to medium-sized businesses to adopt and benefit from these technologies. In simpler terms, it's now easier and more cost-effective for smaller operations to use advanced tech like IoT and AI, thanks to the reduced prices and greater accessibility of cloud services. There was a time when servo technology was expensive and unreliable but now it is on every new machine. The second reason to consider is that investing in AI can be compared to saving for retirement. Just as beginning your retirement savings early can lead to significantly larger gains due to compound interest, starting to implement AI technology sooner rather than later can lead to vastly greater advantages as the benefits accumulate over time. This is because all Artificial intelligence models need good-quality data.

It’s no secret that over the past 10 years, Artificial Intelligence (AI) has brought many innovations like augmented reality (AR) and virtual reality (VR) solutions to the manufacturing shop floor. VR headsets or smart glasses help manufacturers work with suppliers to troubleshoot a machine immediately, without the delay of travel time, shop visits, and sometimes even training. This technology has also led to predictive maintenance on machines. Digital twins help manufacturers speed up training and product development processes. With the high volume of new machine installations in the past few years, these technologies have become standardized and will continue to be part of the future.

Categories of AI in Manufacturing

Currently, there are 2 important categories of AI in Manufacturing.

Machine Learning: Tools that Supplement and Supercharge Current Operations and Talent

- Augmented Intelligence
- Learned Algorithms

Deep Learning: Autonomous Intelligence

- Generative AI
- Acts Independently

Machine Learning:

Tools that Supplement and Supercharge Current Operations and Talent

Automation like Robotics and newer equipment deliver efficiencies, but they also deliver a data source that previously has not been cost effective or useful to harness. If you collect and connect this data with the right AI tools you get that first layer of intelligence: Augmented Intelligence. The tools used to leverage this data and provide results fall under the technical term machine learning. Machine Learning (ML) focuses on the development of algorithms and models that enable computers to learn from data and make predictions or decisions without explicit programming. The key parameter is unlike everything we have today in the box plant because the algorithms are not written out by programmers but are learned.

Systems like these can significantly improve both productivity and reliability. For example, an ML system can bring to the attention of maintenance and operations the need to replace specific wear items (predictive maintenance) and, given authority, even order the part automatically so you

Machine Learning enables computers to learn from data and make predictions or decisions without explicit programming.

are not fighting lead times. We all know how critical the feeder transmission is on a traditional machine. With the right sensors and the application of machine learning, a system can predict the transmission failure weeks in advance - giving the operations team ample time to plan downtime and proactively change it. To be fair, there was a time when experienced and skillful maintenance techs could do the same based on their knowledge. But that is a hard skill to find today, and machinery has also changed significantly in the past decade making some of that knowledge obsolete.

Let's take the example of machine learning models deployed for machine reliability. The power of AI is that it is not making this recommendation based on a set rule but rather from a learned understanding of the typical use of the machine, the type of orders you're running, the actual sensor feedback and historical failures. It's like having that hard-to-find machine maintenance expert make recommendations. True AI learns without the need for added engineering as long as it's given input and enough resources (computing power), it will learn from its mistakes quickly. Similarly, it can suggest (like an experienced operator) how best to run a certain order to maximize output and quality. This is where the augmented portion is truly transformational for box plants. With systems like this there can be a 20% or more increase in OEE, 30% or more in quality, with 30% or so decrease in overall costs. That is the impact this technology has had in early adopters in other industries. (reference, https://www2.deloitte.com/us/en/insights/industry/manufacturing/manufacturing-industry-outlook.html).

Box plant general operations is another area where AI tools can have a profound impact.

"AI can best be implemented from the inside out. As a manufacturer, you want to know what is happening in the plant. You may want to know the top order, the shipping day, machine problems. And you want this information without having to create reports manually. With the ability to do this all through AI, you can increase work efficiency by as much as 40%. Training is more effective by up to 54%. You can see what is happening in Design, on the CAD table, and looking at measurements such as 'how do I get 10 boxes on a tray, and x number of trays in a truck,' and more. AI facilitates a quicker, more accurate rate of knowing what is happening in your plant 24 hours a day. Education and training, office support, and production work is where AI is really going to help. Start generally, not specifically. If you don't have the support in place right now, bring in experts to help implement customer service, production, and training. Focus on real world situations."

~AICC member Greg Tucker, Bay Cities

Deep Learning:

Autonomous intelligence

Quite a few of the more exciting and flashy AI tools we have seen this past year are the result of deep learning models. You may have heard of generative AI (creating images, video, and sound that are new and unique based on basic direction. We saw at AICC Louisville how chat-based tools and other commercially available ones can make a huge difference in packaging design both in creativity and time to market. Broadly one could say that these tools will transform the front office first before it hits the production floor and machinery. The biggest players today are OpenAI (Microsoft backed) and DeepMind (Google backed).

Where we can start to see the value in box plants is in sales, marketing, design, and administrative tasks. We are going to have access to AI tools that take good meeting minutes and distribute them with insights. Or combine several spreadsheets, analyze, and summarize the data in minutes without being an Excel wiz. The key is autonomous intelligence technology acts independently of human input, taking over manual and cognitive tasks that require fast adaptation to new data. Think of this as automation for people's tasks. It will change our workforce but also give us options to better align with our goals. Our sales teams can engage more freely with customers without laboring over documentation. Our production teams can spend more energy tackling long-term and larger challenges and efficiency without worrying about how to better run the 20 orders in the queue. By and large the big impact here is in eliminating small tasks that are time and labor-intensive.

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All AICC products begin with our members. The AI Primer from AICC is a series of "whitepapers" on artificial intelligence, that have been (and will be) written by AICC members from the AI sub-committee, other AICC members, and subject matter experts. We thank each of them for their contribution to this educational tool.

About AICC, The Independent Packaging Association

We are a growing membership association which serves independent corrugated, folding carton, and rigid box manufacturers and suppliers with education and information in print, in person, and online. AICC membership is for the full company and employees at all locations have access to member benefits. AICC offers free online education to all members to help the individual maximize their potential and the member company maximize its profit. When companies invest and engage, AICC delivers success.

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