RESEARCH SPOTLIGHT

MAKING IIoT USE CASES WORK FOR DISCRETE MANUFACTURERS

Executive Summary

When it comes to the use of automation, discrete manufacturers have been particularly susceptible to a well-known, decades-old architectural challenge: "islands of automation."

As automation has been deployed, (i.e., PLCs, HMI/SCADA, Material Handling Systems, Robots, CNCs, etc.) the scope of deployment has been at the machine, work-cell, or line-level; driving high degrees of efficiency gains in specific areas of factories. But, unfortunately, the data being created by these deployments largely remains locked within these automation systems, unused - except for low levels of data (and even lower levels of intelligence) being moved up into MOM/MES or ERP systems.

This is in direct contrast to process industry companies where the deployment of automation has evolved very differently. Process industries commonly use Distributed Control Systems (DCS), which are broad-based, plant-wide automation systems; these systems often include tens of thousands of IOs and many connected assets, instruments, and sensors, all streaming into centralized data historians. Because of this wealth of centralized plant-level data, a whole host of data-centric modeling, simulation, and optimization tools have permeated the industry. With process engineers embracing the use of technologies like Advanced Predictive Control (APC) and Model Predictive Control (MPC) to make better operational decisions, process industry companies became accustomed to using real-time data to drive improved profitability and growth. As these tools became more widely used, they subsequently changed the culture and skillset across these industries.

As discrete manufacturers move into the Industry 4.0 era and embrace Industrial Internet of Things (IIoT) technologies, these Industry 3.0 differences pose both a challenge and opportunity to learn. In particular, discrete manufacturers need to adopt strategies and capabilities that ensure previous islands of automation don't become islands of data and intelligence – or lost opportunities.

Unfortunately, most early movers in discrete manufacturing, including companies in automotive, aerospace and defense, metal forming, and more, have not yet learned these lessons and have fallen behind their peers in process and batch manufacturing industries in terms of achievements in Industrial Transformation (IX) and IIoT. (LNS Research defines IX as a proactive and coordinated approach

> "Discrete manufacturers need to adopt Industrial Transformation (IX) strategies and capabilities that ensure previous islands of automation don't become next-generation islands of data or intelligence."

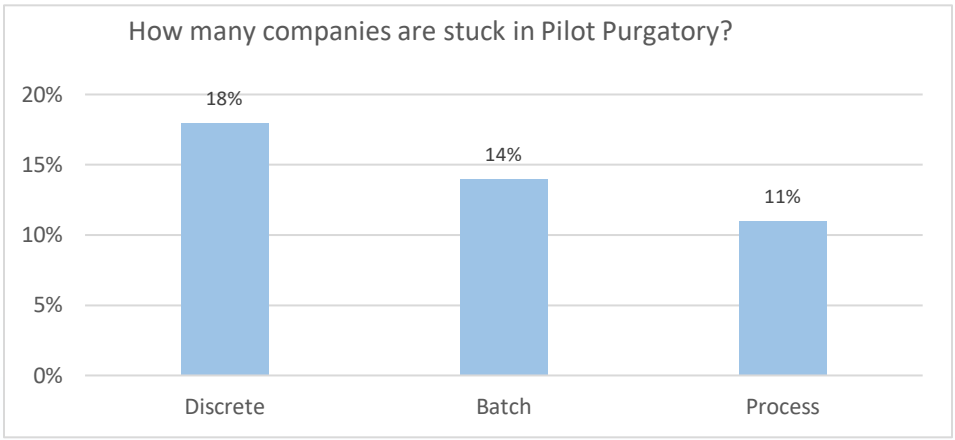
—PATRICK FETTERMAN
Research Analyst

to leveraging digital technologies to create step-change improvement in industrial operations.)

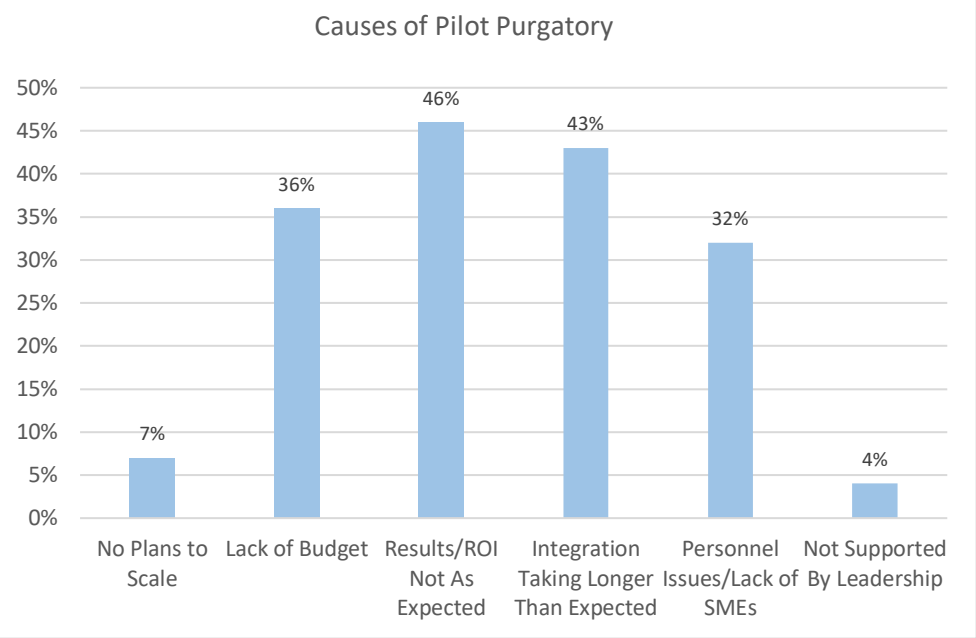
Discrete Manufacturers: Getting Stuck in Pilot Purgatory

LNS Research surveyed 278 industrial companies and asked them to report results of their IX initiatives, allowing us to identify which companies are leaders (moving ahead rapidly and seeing results from programs), which companies are laggards but still moving towards adoption, and which are stuck in "Pilot Purgatory" – that dreaded state where a pilot program doesn't deliver anticipated results, and so never scales (and in some cases never dies). The results for discrete manufacturers were not positive.

- Discrete manufacturers are getting stuck in Pilot Purgatory at higher rates than their counterparts in both batch and process manufacturing industries.
- Smaller companies (<$1 billion) are TWICE as likely to report being stuck as companies $1 billion - $10 billion.



Putting these two findings together means that discrete manufacturers with less than $1 billion in revenue are finding themselves falling far behind their counterparts in other industries (and falling behind the few companies in their own industries who are successfully pursuing these strategies). How has this happened to industries that pioneered operational excellence programs such as continuous improvement and lean manufacturing?



LNS Research has aggregated the data shown in the chart above and used this to identify the most common failure modes for discrete manufacturers. Note that these are not the typical "enterprise project" failures (e.g., lack of support from leadership is a negligible problem) that one might expect for new initiatives. Rather, there are specific, addressable reasons that are causing the projects to get stuck.

The most readily identifiable causes are:

Lack Of An Operational Architecture That Supports IX And Advanced Analytics: While process manufacturing industries have long used instrumentation, automation systems, data historians, and advanced process control (APC) technologies to improve realtime operations, this approach is still new for most discrete manufacturers. Relatively few discrete manufacturers have built data science teams with expertise in the time-series data formats most commonly seen with factory data, and even fewer have built the data lakes required to gather this information while keeping its context and conditioning intact. Furthermore, discrete manufacturers are, in some cases, being distracted by emerging next-gen OT, such as vision systems, additive manufacturing, or cobots, but they may not be thinking architecturally about how these technologies can integrate into the

manufacturing process and scale quickly. This is especially true for discrete manufacturers in the sub $1 billion revenue segment; staffing a full-blown data science team or integrating multiple enterprise applications is likely beyond the budget and resources of most of these organizations. Similar issues are seen when looking at integration of emerging IIoT systems and existing OT systems. However, cross-training IT-OT organizations with OT data concepts and investing in data management systems can pay large dividends for these companies.

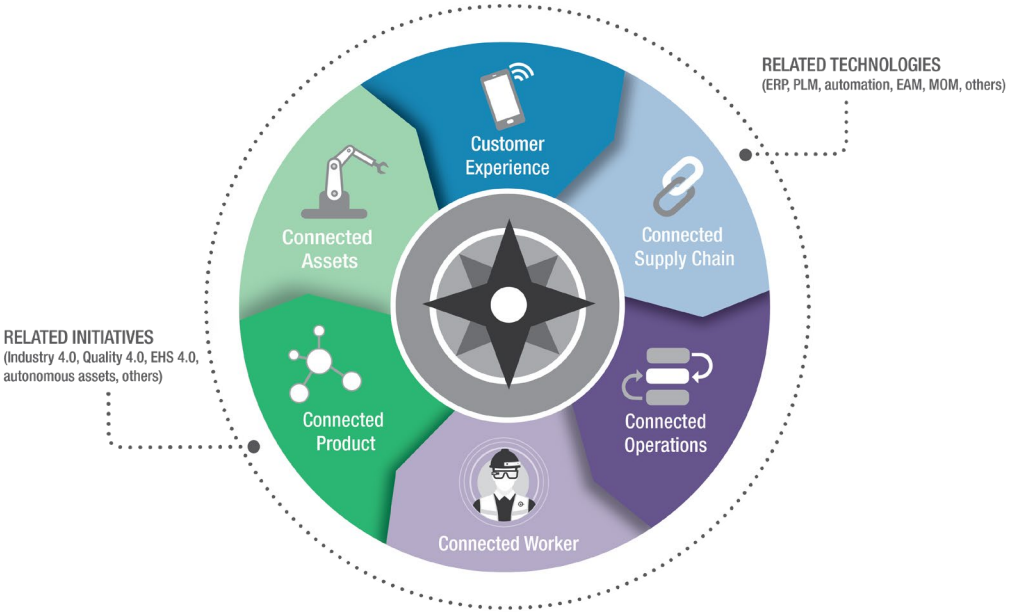
Focusing IX Initiatives On New Technologies Instead Of Critical Manufacturing Operations Use Cases Integrated To The Rest Of The Value Chain: Like other industries, discrete manufacturers are often focused on applying new technologies like analytics or AI to challenges outside the plant (e.g., on invoice-payment matching or supply chain risk management), rather than integrating plant and corporate data and focusing on manufacturing operations challenges. In fact, our research shows that discrete manufacturers are more likely than process companies to focus on use cases *outside* of their factories; however, our research also shows that most of the high value use cases are *within* manufacturing operations, rather than in corporate operations or finance, for example. For discrete manufacturers, this focus outside of the factory is easy to understand; applying new technologies to critical manufacturing operations is considered high risk by plant managers and has historically been avoided. However, our research shows that manufacturers get the strongest ROI from focusing IX initiatives use cases within these manufacturing operations.

The LNS Research Use Case Navigator

LNS Research created the Use Case Navigator in order to classify and track IX use cases. Currently, the six categories defined in the Navigator include 35 separate (but sometimes overlapping) use cases. By tracking and reporting on the value of these use cases (and correlating with other factors in our research surveys), we can identify high value, high priority use cases, and can provide guidance for discrete manufacturers on where they should be focusing their IX initiatives.

The six categories included in the Use Case Navigator are defined as:

1. **Customer Experience**: e.g., online marketplaces, complaint analysis, and warranty issues
2. **Connected Supply Chain**: e.g, supplier quality, realtime supply chain visibility, and traceability
3. **Connected Operations**: e.g., industrial operations such as maintenance, product variations and quality
4. **Connected Worker**: e.g., smart worker technology such as wearables and AR
5. **Connected Product**: e.g., product monitoring, recall control, and field service
6. **Connected Assets**: e.g, performance monitoring, maintenance, and process optimization

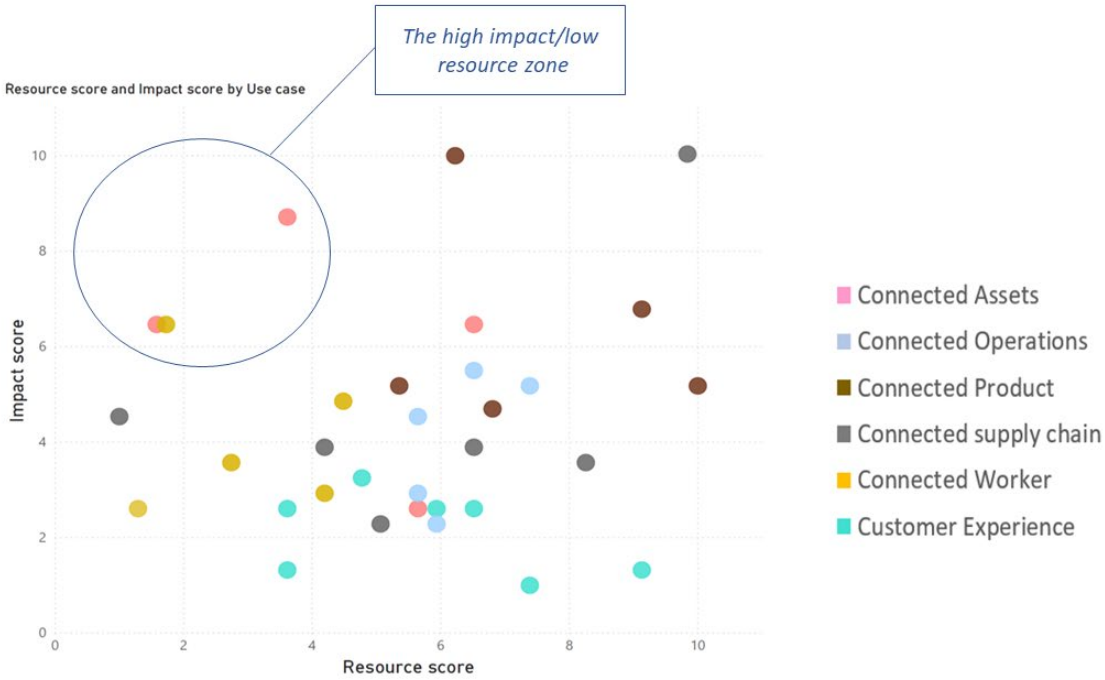


These six categories include the fundamental business and industrial operations of manufacturers and industrial companies, from procurement to manufacturing or processing all the way through delivery and customer experience. All of these are being transformed through digital technology into something completely new.

Results: Which Use Cases Work for Discrete Manufacturing

In our survey of 278 industrial companies, we asked respondents which types of IX initiatives they had undertaken (based on the categorization above) and asked them to rank both the impact of those use cases, and the resources (including budget) required. Rankings were on a scale of 1-10, with 1 the lowest score and 10 the highest. Ideally, we were looking for use cases that had limited resource

requirements (i.e., a low score for resources) and a high impact score. Filtering for discrete manufacturing industries, we identified 4 top use cases:



- **Asset Performance Monitoring** for all systems, including assembly components, robots, closed loop systems, and more. Monitoring the performance of these systems based on sensor data has been performed for many years in other industries but is newer in discrete manufacturing. The science behind applications such as vibration analysis has improved greatly, for example, improving the value of these performance monitoring systems.
- **Predictive Maintenance** for high-cost assets (e.g. stamping machines, annealing ovens, robots, etc.). This model is based on sensor data, rather than usage data or schedule tracking. Given the high level of dependency on these mission-critical assets, anything that can improve uptime and/or lower costs of maintenance is highly desirable for these manufacturers. LNS has written extensively about the advancements in analytics, from descriptive to diagnostic to predictive and eventually, to prescriptive analytics. For now, the sweet spot seems to be the predictive stage.
- **Predictive Quality** has been attempted by different means for a few decades; in our research we specified leveraging sensor and machine data for predictive quality – and we learned that it pays high returns for discrete manufacturers. While many discrete manufacturers have improved quality drastically in the last 20 years, the returns for classic "Continuous

Improvement" and "World Class Manufacturing" programs have been diminishing in recent years as the low-hanging fruit has been harvested and there are fewer areas for improvement. This new model for predictive quality, based on sensor and machine data, is proving fruitful for companies.

- **Mobile Apps or Augmented Reality to Scale Rare or Expert Skills**. For example, a machine expert may use a mobile app or AR headset system to guide a remote technician through a complex diagnostic or maintenance app. Note that AR is not required here; it's just one option for delivering this type of service, with mobile apps and voice communications providing a simpler and less costly alternative. This use case is driven by the dynamics of human resources and the scarcity of expert skills, especially in remote or rural areas where many large factories are located.

Best Practices In Use Case Selection and Implementation

When choosing the use cases to pursue in your organization, taking a matrix-based approach as highlighted above is an effective start. Our research has also identified additional best practices for use case selection and implementation, based both on learning from IX leaders and process industry exemplars. These include:

- **Scale use case across multiple sites in a department/function**. In other words, utilize predictive maintenance successfully in one plant or cell or line, then take that successful implementation model to other plants with similar requirements. Companies who follow this model, rather than moving from one use case to another within a single plant, are achieving greater rates of success and higher levels of executive buy-in.
- **Carefully plan integration strategies for new systems and "monument" systems**. Whether it's a PLM, ERP, or MES/MOM solutions, workers within discrete industries have become accustomed to working within these monument systems on a daily basis. Planning how to integrate the newly acquired data and use case outcomes into these systems makes it easier for workers to embrace the data and builds a level of trust.
- **Incorporate data from and share data with internal and external sources**. While many discrete manufacturers are used to pulling data from suppliers, our research shows that the most successful companies are integrating that data into their new systems and are sharing the outcome of the data with suppliers, partners, and even customers. This is a monumental cultural shift for some companies and needs to be planned for carefully.

- **Empower plant staff with data and decision-making authority.** To their credit, discrete manufacturers have moved to embrace the empowered factory worker faster than several other industries. If your company has NOT made this cultural shift, it's time to figure out why, and to make the first steps towards enabling plant workers to make smart decisions.

Summary and Recommendations

Good news? The 76% of discrete manufacturers that haven't yet embraced these new IIoT technologies and IX initiatives can do so in a way that moves them ahead of the early adopters, learning from the successes in the process industries. Discrete manufacturers should:

- **Avoid the temptation to start the IX journey with next-generation automation technologies** that will just create next-generation islands of automation, e.g., cobots, vision systems, additive manufacturing, wearables, etc.
- **Start by identifying the use cases that have the lowest effort needed to implement and the highest impact** to the business. Then bring in the right technologies and capabilities to deliver on the use case.
- **When pursuing prioritized use cases, don't forget the value of liberating data from legacy and next-gen automation** with IIoT technologies, a common data model, and analytics – and that the use of these tools needs to be complimented by and supported by a culture and skill-set that embraces the use of realtime data to optimize operations.
- **Build on organizational strengths**. Discrete manufacturers have a strong heritage of Lean, Six Sigma, and Operational Excellence. These leaders have typically lived in the world of paper, Excel spreadsheets, and dated batch reports from ERP, MES, and Quality systems. Upskilling to become comfortable with next-gen data collection and analytics tools will jumpstart performance improvements.

Discrete manufactures who follow these lessons and move quickly to adopt the right use cases for their business challenges can make significant impacts on their business performance in the short term and can position themselves for long-term success in their IX initiatives.

Presented by:

Authors:

Matthew Littlefield
President and Principal Analyst
matthew.littlefield@lns-global.com

Patrick Fetterman
Research Analyst
patrick.fetterman@lns-global.com

Vivek Murugesan
Research Associate
vivek.murugesan@lnsresearch.com

Sponsored by:

PLEX

https://www.plex.com/

LNS Research provides research and advisory services to guide companies through industrial transformations. Our research focuses on how digital technology drives industrial transformation across the value chain and offers insights into the people, processes, and technologies required for achieving Operational Excellence. Learn more at www.lnsresearch.com.