

F R O S T & S U L L I V A N

FROST & SULLIVAN BEST PRACTICES AWARD

EDGE-TO-CLOUD IIOT ENABLEMENT PLATFORM
FOR MANUFACTURING - NORTH AMERICA

New Product Innovation 2019

LITMUS
Automation

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2019

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Background and Company Performance

Industry Challenges

The primary challenge for manufacturing companies when they begin their Industry 4.0 and Industrial Internet of Things (IIoT) projects is that they have numerous discrete industrial devices, systems, and protocols from various automation vendors, and connecting to these varied assets can be difficult. In addition, industrial devices and systems do not communicate securely over the Internet and in the cloud. Therefore, between various machine vendors and fragmented enterprise applications and analytics suites, an easy-to-use product suite is needed to securely manage the various IIoT deployments at scale.

As Industry 4.0 and IIoT projects grow, challenges in scaling and deploying solutions across modern and legacy devices, assets, and applications are growing as well and becoming more complex. In addition, management becomes a challenge once companies start scaling across different factories and locations, and a solution that can manage these deployments at scale is needed because updating all the different remote sites individually is not feasible.

Another industry challenge for customers is having data in proper structures and formats that are more easily usable for analytics and modern IT systems. Therefore, vendors need to develop IIoT products that seamlessly integrate and analyze industrial devices from the edge to the cloud. Under such circumstances, vendors that can offer a secure edge-to-cloud enablement platform for IIoT and address the aforementioned challenges are expected to secure a leadership position in the market.

New Product Attributes and Customer Impact

New Product Attributes

Founded in 2014, California-based Litmus Automation Inc. is strongly committed to maximizing the value proposition to its customers in the manufacturing industry and offers LoopEdge (an edge computing platform) and Loop (a cloud-level management layer for LoopEdge) as a unified edge-to-cloud IIoT platform that provides customers with a foundation for their Industry 4.0 initiatives.

Frost & Sullivan finds that these two innovative products offer a unique value proposition to customers on the following fronts:

LoopEdge: LoopEdge is installed out-of-the-box on any IoT gateway or industrial PC, and connectivity is one of the solution's core competencies. Litmus Automation has some of the highest amounts of device connectivity worldwide, covering 80% of the market. The extensive amount of device/protocol drivers that Litmus Automation has created speaks to all the different types of devices, systems, and controllers. To this end, Litmus Automation adds about five to seven drivers every month. LoopEdge runs as an edge operating system (OS) and provides seamless and secure connectivity to legacy industrial devices and systems, such as programmable logic controllers (PLCs), distributed control systems (DCSs), controllers, robotic systems, computer numeric control (CNC) machines, third-

party sensors, historians, and many other different legacy operational technology (OT) devices that go way back, even to the 1960s, from various automation vendors.

At a high level, LoopEdge can quickly analyze the industrial system data at the edge and is installed on a gateway or industrial PC right next to these assets on the factory floor. A local message broker running inside LoopEdge collects data from these industrial devices and systems; pre-processes, filters, analyzes, and stores the data locally; and then makes that data available to other applications running inside LoopEdge, to external systems, or to the cloud.

Litmus Automation provides customers with access to over 45 preloaded applications and solutions from the LoopEdge marketplace, or customers can load their own applications and leverage them from that marketplace. In addition, data can be pushed to external systems through OPC unified architecture (UA) or other application programming interfaces (APIs).

The data can be pushed to the cloud through the company's 15 cloud integrations, such as Microsoft Azure, Amazon Web Services (AWS), and Google Cloud Platform, as well as to other enterprise integrations, such as SAP and Oracle. Furthermore, an extensive management layer manages LoopEdge in terms of applications, firmware, security, and remote access. For example, customers can remotely access LoopEdge from anywhere to troubleshoot or configure and then manage all applications and devices themselves.

Product Differentiation: LoopEdge is unique in the industry because it can speak to all the different industrial devices and systems. Competing products that can speak to industrial systems are legacy products, such as OPC servers; however, they are not meant for IIoT because they are difficult to manage across different factories, have no built-in security, and are not meant to communicate to the cloud. Moreover, Litmus Automation provides many capabilities to its full edge computing system and management layers, such as pre-filtering data, pre-analyzing data, running applications at the edge, and connecting securely to the cloud and management layer on top, all of which Litmus Automation's competitors fail to provide.

Loop: As manufacturing companies begin scaling across different factories and remote sites, Litmus Automation's counterpart product, Loop, connects all the various LoopEdge gateways, centralizes the data, and then manages the entire lifecycle of edge devices, including mass provisioning devices, sending firmware updates over-the-air (OTA), deploying applications to the edge, and running logic at the edge. Either Litmus Automation can host Loop on its own Azure platform, or the customer can host Loop on their own AWS, Azure, or Google platforms as well as in their own private data centers.

LoopInsights: While LoopEdge and Loop are Litmus Automation's core products, the company offers an add-on application called LoopInsights, which allows customers to create their own dashboards and visualizations across different factories. LoopInsights provides quick and easy visualization at the cloud or data center level.

Frost & Sullivan finds that LoopEdge and Loop are productized, as opposed to being a generic system, where customers still have to build their own components to make it work and is user-friendly.

Frost & Sullivan appreciates Litmus Automation's comprehensive/turnkey/full framework solutions because customers can build multiple use cases instead of having to determine custom integrations from scratch. A key differentiator is that Litmus Automation's customers do not require many resources on their end because they can deploy the products on their own, without needing a system integrator approach. Therefore, from industrial data collection and edge analytics to central IoT management, Litmus Automation's innovative and unified IIoT edge-to-cloud platform provides customers with the foundation for any Industry 4.0 initiative.

Customer Impact

Since the launch of LoopEdge and Loop two years ago, Litmus Automation has acquired about 20 customers through outbound sales initiatives, targeted outreach (45% of opportunities have come through this targeted outreach), trade shows, focused events around IIoT, and through partners and distributors. From an IIoT perspective, the company mainly focuses on industrial sectors, where manufacturing is its primary market, and oil and gas, mining, and smart cities are its secondary markets.

Litmus Automation works mainly with large-scale Fortune 500 customers that have multi-site deployments. Some of its leading customers include Saint-Gobain, Flex Ltd, Renault, Schlumberger, and JVC. In addition, the company works with several original equipment manufacturers (OEMs) and machine builders, such as Parker Hannifin Corp (which has white-labeled the LoopEdge platform), Cleaver-Brooks Inc, and HPE (white-labeled).

Manufacturing companies find Litmus Automation's Loop and LoopEdge platforms appealing because they can seamlessly connect all their disparate industrial devices, systems, and legacy equipment machines and obtain a 360-degree view of all their operations. Another attractive factor for customers is that they do not need to rely on intermediaries for deployment. For instance, Saint-Gobain (automotive glass manufacturing unit), on a mission to achieve 100% Industry 4.0 asset connectivity across 37 factories, achieved a 100% self-service (completely productized) deployment using LoopEdge and Loop, without needing a system integrator. Saint-Gobain chose Litmus Automation over its closest competitor that offers OPC servers for industrial connectivity. Saint-Gobain deployed LoopEdge on top of its HPE hardware, thereby providing standard connectivity across all machines.

Saint-Gobain's data science team analyzes the data in its own machine learning (ML) systems to understand the different anomalies, write different algorithms, and deploy the algorithms back inside LoopEdge to take action on the data in real time. Therefore, in the case of any type of anomaly or pre-determined threshold, LoopEdge can send an alert to local maintenance personnel so that they can service the device or machine. Moreover, Litmus Automation has bidirectional control so it can write back and turn off the device/machine and then notify the appropriate personnel. Using LoopInsights, Saint-Gobain can now create different key performance indicators (KPIs) in terms of overall

equipment effectiveness (OEE); create dashboards across factories; visualize uptime, downtime, and yield; and drill down to the individual factory to observe asset performance.

In terms of expanding into more target accounts, Litmus Automation works in concert with its partners. For example, the company has a business development strategy in place that hinges on close working relationships with system integrators, distributors, and hardware and cloud partners. Therefore, Litmus Automation has built an extensive ecosystem with some of the most prominent names in the industry, such as BCG, SNC-Lavalin, HPE, Intel, Microsoft Azure, and Google Cloud Platform.

Going forward, Litmus Automation is expected to enhance its team size, working capital, and customer engagement in the next few months following a Series A funding of \$7 Million from Mitsubishi Corporation.

Conclusion

Litmus Automation's LoopEdge and Loop software platforms successfully address manufacturing companies' need for an IIoT platform that can seamlessly and securely connect, manage, analyze, and integrate their industrial devices from the edge to the cloud.

The company renders unmatched product value because LoopEdge connects both legacy and modern devices from different vendors and analyzes data right at the edge, whereas Loop manages and integrates the lifecycle of all edge devices remotely. Frost & Sullivan commends Litmus Automation for enabling its manufacturing customers' Industry 4.0 teams to deploy and operate a unified edge-to-cloud system.

With its strong overall performance, Litmus Automation has earned Frost & Sullivan's 2019 New Product Innovation Award.

Significance of New Product Innovation

Ultimately, growth in any organization depends upon continually introducing new products to the market and successfully commercializing those products. For these dual goals to occur, a company must be best-in-class in three key areas: understanding demand, nurturing the brand, and differentiating from the competition.



Understanding New Product Innovation

Innovation is about finding a productive outlet for creativity—for consistently translating ideas into high-quality products that have a profound impact on the customer.

Key Benchmarking Criteria

For the New Product Innovation Award, Frost & Sullivan analysts independently evaluated two key factors—New Product Attributes and Customer Impact—according to the criteria identified below.

New Product Attributes

- Criterion 1: Match to Needs
- Criterion 2: Reliability
- Criterion 3: Quality
- Criterion 4: Positioning
- Criterion 5: Design

Customer Impact

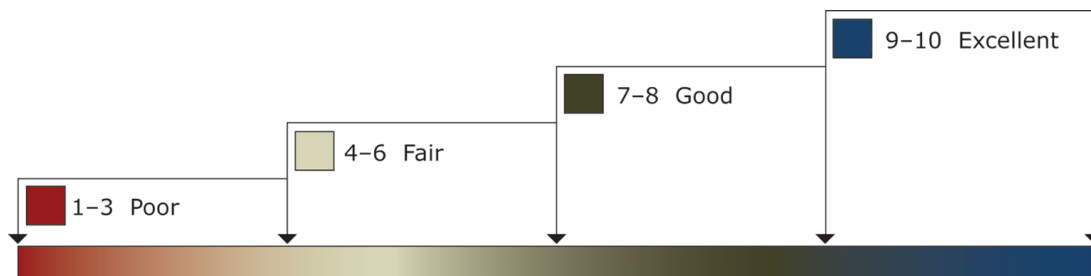
- Criterion 1: Price/Performance Value
- Criterion 2: Customer Purchase Experience
- Criterion 3: Customer Ownership Experience
- Criterion 4: Customer Service Experience
- Criterion 5: Brand Equity

Best Practices Award Analysis for Litmus Automation

Decision Support Scorecard

To support its evaluation of best practices across multiple business performance categories, Frost & Sullivan employs a customized Decision Support Scorecard. This tool allows our research and consulting teams to objectively analyze performance, according to the key benchmarking criteria listed in the previous section, and to assign ratings on that basis. The tool follows a 10-point scale that allows for nuances in performance evaluation. Ratings guidelines are illustrated below.

RATINGS GUIDELINES



The Decision Support Scorecard is organized by New Product Attributes and Customer Impact (i.e., These are the overarching categories for all 10 benchmarking criteria; the definitions for each criterion are provided beneath the scorecard.). The research team confirms the veracity of this weighted scorecard through sensitivity analysis, which confirms that small changes to the ratings for a specific criterion do not lead to a significant change in the overall relative rankings of the companies.

The results of this analysis are shown below. To remain unbiased and to protect the interests of all organizations reviewed, we have chosen to refer to the other key participants as Competitor 2 and Competitor 3.

<i>Measurement of 1–10 (1 = poor; 10 = excellent)</i>			
New Product Innovation	New Product Attributes	Customer Impact	Average Rating
Litmus Automation	9.0	9.0	9.0
Competitor 2	8.0	8.0	8.0
Competitor 3	7.0	7.0	7.0

New Product Attributes

Criterion 1: Match to Needs

Requirement: Customer needs directly influence and inspire the product’s design and positioning.

Criterion 2: Reliability

Requirement: The product consistently meets or exceeds customer expectations for consistent performance during its entire life cycle.

Criterion 3: Quality

Requirement: Product offers best-in-class quality, with a full complement of features and functionalities.

Criterion 4: Positioning

Requirement: The product serves a unique, unmet need that competitors cannot easily replicate.

Criterion 5: Design

Requirement: The product features an innovative design, enhancing both visual appeal and ease of use.

Customer Impact

Criterion 1: Price/Performance Value

Requirement: Products or services offer the best value for the price, compared to similar offerings in the market.

Criterion 2: Customer Purchase Experience

Requirement: Customers feel they are buying the most optimal solution that addresses both their unique needs and their unique constraints.

Criterion 3: Customer Ownership Experience

Requirement: Customers are proud to own the company’s product or service and have a positive experience throughout the life of the product or service.

Criterion 4: Customer Service Experience

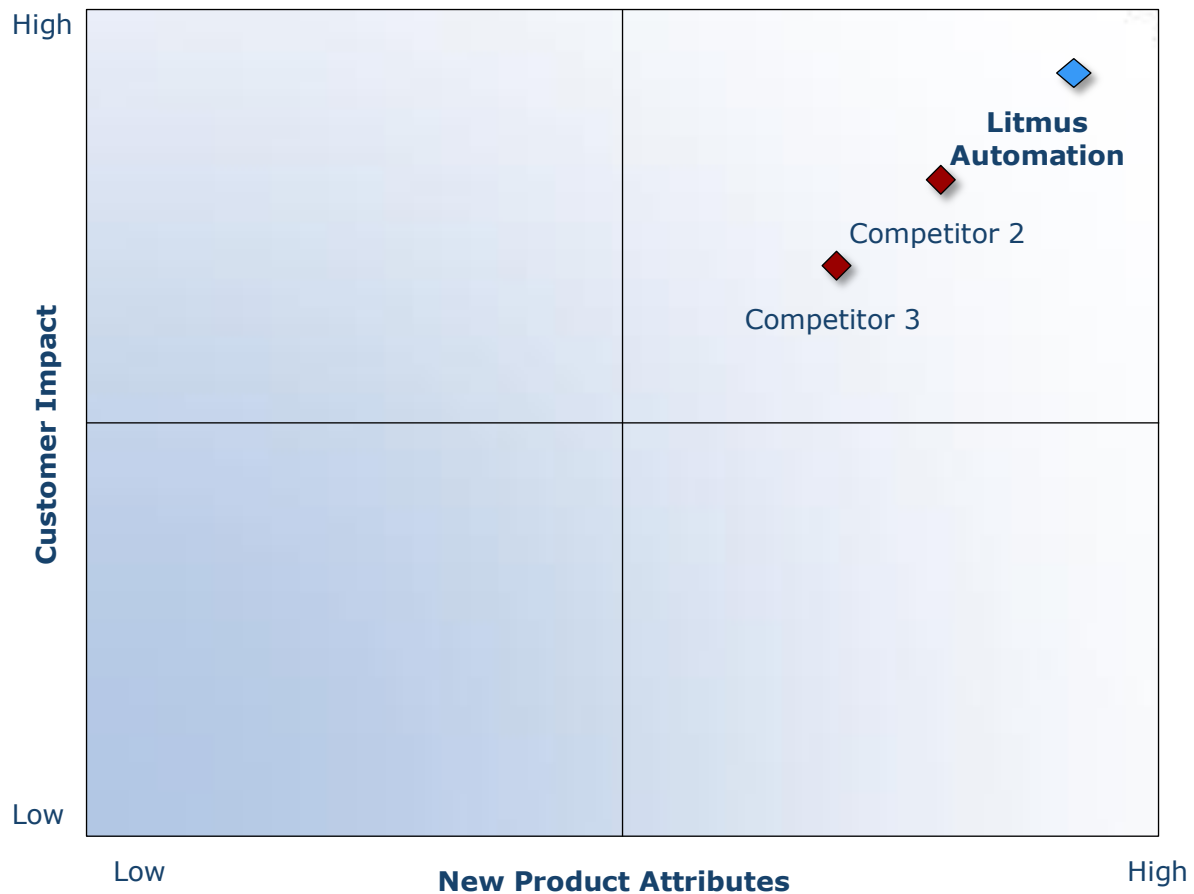
Requirement: Customer service is accessible, fast, stress-free, and of high quality.

Criterion 5: Brand Equity

Requirement: Customers have a positive view of the brand and exhibit high brand loyalty.

Decision Support Matrix

Once all companies have been evaluated according to the Decision Support Scorecard, analysts then position the candidates on the matrix shown below, enabling them to visualize which companies are truly breakthrough and which ones are not yet operating at best-in-class levels.



Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices

Frost & Sullivan analysts follow a 10-step process to evaluate Award candidates and assess their fit with select best practice criteria. The reputation and integrity of the Awards are based on close adherence to this process.

STEP	OBJECTIVE	KEY ACTIVITIES	OUTPUT
1 Monitor, target, and screen	Identify Award recipient candidates from around the globe	<ul style="list-style-type: none"> • Conduct in-depth industry research • Identify emerging sectors • Scan multiple geographies 	Pipeline of candidates who potentially meet all best-practice criteria
2 Perform 360-degree research	Perform comprehensive, 360-degree research on all candidates in the pipeline	<ul style="list-style-type: none"> • Interview thought leaders and industry practitioners • Assess candidates' fit with best-practice criteria • Rank all candidates 	Matrix positioning of all candidates' performance relative to one another
3 Invite thought leadership in best practices	Perform in-depth examination of all candidates	<ul style="list-style-type: none"> • Confirm best-practice criteria • Examine eligibility of all candidates • Identify any information gaps 	Detailed profiles of all ranked candidates
4 Initiate research director review	Conduct an unbiased evaluation of all candidate profiles	<ul style="list-style-type: none"> • Brainstorm ranking options • Invite multiple perspectives on candidates' performance • Update candidate profiles 	Final prioritization of all eligible candidates and companion best-practice positioning paper
5 Assemble panel of industry experts	Present findings to an expert panel of industry thought leaders	<ul style="list-style-type: none"> • Share findings • Strengthen cases for candidate eligibility • Prioritize candidates 	Refined list of prioritized Award candidates
6 Conduct global industry review	Build consensus on Award candidates' eligibility	<ul style="list-style-type: none"> • Hold global team meeting to review all candidates • Pressure-test fit with criteria • Confirm inclusion of all eligible candidates 	Final list of eligible Award candidates, representing success stories worldwide
7 Perform quality check	Develop official Award consideration materials	<ul style="list-style-type: none"> • Perform final performance benchmarking activities • Write nominations • Perform quality review 	High-quality, accurate, and creative presentation of nominees' successes
8 Reconnect with panel of industry experts	Finalize the selection of the best-practice Award recipient	<ul style="list-style-type: none"> • Review analysis with panel • Build consensus • Select recipient 	Decision on which company performs best against all best-practice criteria
9 Communicate recognition	Inform Award recipient of Award recognition	<ul style="list-style-type: none"> • Present Award to the CEO • Inspire the organization for continued success • Celebrate the recipient's performance 	Announcement of Award and plan for how recipient can use the Award to enhance the brand
10 Take strategic action	Upon licensing, company is able to share Award news with stakeholders and customers	<ul style="list-style-type: none"> • Coordinate media outreach • Design a marketing plan • Assess Award's role in future strategic planning 	Widespread awareness of recipient's Award status among investors, media personnel, and employees

The Intersection between 360-Degree Research and Best Practices Awards

Research Methodology

Frost & Sullivan's 360-degree research methodology represents the analytical rigor of our research process. It offers a 360-degree-view of industry challenges, trends, and issues by integrating all 7 of Frost & Sullivan's research methodologies. Too often companies make important growth decisions based on a narrow understanding of their environment, leading to errors of both omission and commission. Successful growth strategies are founded on a thorough understanding of market, technical, economic, financial, customer, best practices, and demographic analyses. The integration of these research disciplines into the 360-degree research methodology provides an evaluation platform for benchmarking industry participants and for identifying those performing at best-in-class levels.

360-DEGREE RESEARCH: SEEING ORDER IN THE CHAOS



About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best-in-class positions in growth, innovation and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best practice models to drive the generation, evaluation, and implementation of powerful growth strategies. Frost & Sullivan leverages more than 50 years of experience in partnering with Global 1000 companies, emerging businesses, and the investment community from 45 offices on six continents. To join our Growth Partnership, please visit <http://www.frost.com>.