FROST & SULLIVAN

BEST PRACTICES AWARDS

nebbiolotechnologies

fog computing pioneers

2019 NORTH AMERICAN IIOT EDGE COMPUTING CUSTOMER VALUE LEADERSHIP AWARD

Contents

Background and Company Performance

Industry Challenges

The Industrial Internet of Things (IIoT) is no longer a new concept in manufacturing and has been prompting businesses to connect their legacy assets to the industrial network. It presents several opportunities for the manufacturing industry to operate more safely and productively, thereby improving efficiencies at unbelievable costs. Frost & Sullivan expects the coming decade will see several billions of devices being connected to the Internet. This trend will spur tremendous growth in demand for various elements of IIoT solutions including protocols, software, hardware, security mechanisms, analytics, and cloud.

Despite all the benefits derivable from IIoT, challenges do exist. In general, the main controllers such as embedded industrial PCs (IPCs) and programmable logic controllers (PLCs) on the factory floor operate in siloes. These controllers function on separate operating system (OS) with unique sets of embedded intelligence. Furthermore, across most factory floors, the information technology (IT) infrastructure is not securely connected to the operational technology (OT) infrastructure. This gap can result in poorly managed operations, leading to unexpected downtime and decreased production efficiency.

Part of the challenge is that the valuable data from the factory ecosystem that could be helpful for predictive maintenance or quality testing remains locked within the machine. Yet a standards-based approach to connectivity through protocols like OPC/UA and TSN requires new hardware and software infrastructure, thereby requiring big investment. Also, the capital expenditure (CAPEX) organizations make in developing the software needs to have a clear plan for return on investment.

Frost & Sullivan sees the future of manufacturing in edge (or fog) computing, which enables integration of functions and use of data analytics to greatly benefit manufacturing end users. In fact, the demand for edge computing is growing exponentially as industrial customers want to process the data generated by their devices at the edge of the network, right where the data is generated. However, lack of experience and expertise regarding edge configurations and concern over information security levels are among the key barriers to deploying edge analytics across manufacturing.

Companies that can offer advanced artificial intelligence (AI)-based edge computing solutions to securely analyze the real-time performance of customers' assets, preempt failure, improve asset lifespan, reduce maintenance costs, and increase production output will find themselves best positioned to stay competitive in the dynamic North American manufacturing market.

Customer Impact and Business Impact

Performance Value

California-based Nebbiolo Technologies has developed an edge computing infrastructure to facilitate data storage, analysis, and networking between edge devices and cloud. Nebbiolo's fog computing solution has been designed to support both industrial and commercial IoT end users. Frost & Sullivan recognizes that a key value proposition of Nebbiolo's software platform is that it is the market's first advanced hyper-converged infrastructure for IIoT edge applications. The company's customer-centric approach enables end users to monitor in real-time their IIoT device control. Furthermore, Nebbiolo's AI-based advanced analytics positions end users to instantly determine the status of a process and performance data so that problems can be addressed proactively, without causing downtime on the factory floor. Thus, with Nebbiolo's next-generation fog solutions, end users can effectively leverage the power of predictive analytics.

Nebbiolo's mission is to transform industrial systems by providing a new infrastructure at the edge, based on the modern Edge and Fog Computing paradigm. To achieve this goal, it encompasses a four-fold approach: i) virtualization, ii) modern management with or without cloud iii) cybersecurity, iv) data-driven insights at scale. Nebbiolo's technology simplifies legacy OT and drives factory floor digitalization by enabling a new class of IIoT applications. In contrast to industry competitors who offer basic solutions such as data analytics, Nebbiolo offers advanced data services for monitoring and diagnostics, machine performance optimization, predictive maintenance, and advanced real-time control.

Customer Ownership Experience

Committed to delivering a fulfilling ownership experience to customers, Nebbiolo's edge computing platform is powered by a highly functional fogOS (fog operation system) stack that is centrally managed by the fogSM (fog system manager), which may be deployed either in the Cloud, or on-premises. In contrast to its top competitors who do not support customers that own legacy systems, Nebbiolo supports both outdated and modern systems.

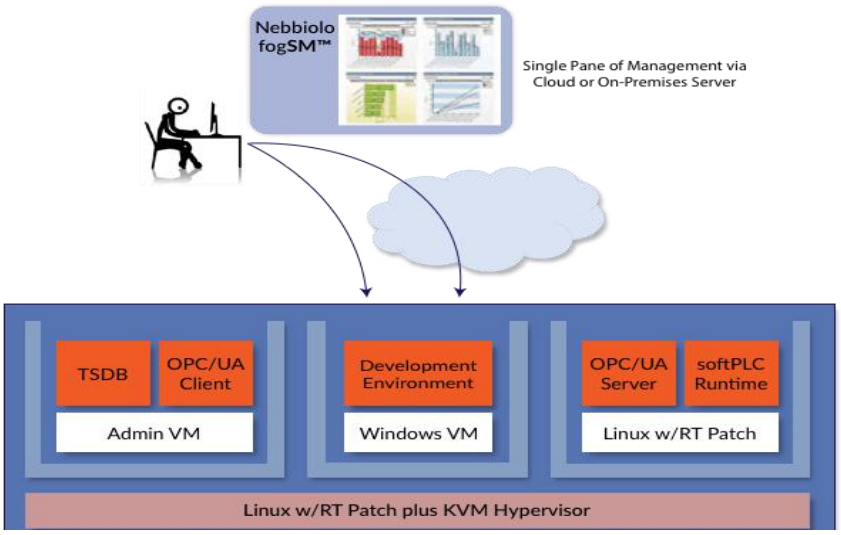


Figure 1: Nebbiolo fogSM™ Machine-Fog Solution

To achieve this, its edge computing platform virtualizes and thus consolidates and offers modern centralized management to customers' hardware and software components. Some manufacturers run an outdated OS such as Windows XP or Windows 2003, which are no longer supported by Microsoft. Nebbiolo transforms such unmanaged and outdated OS into virtual machines and hosts them on its edge computing platform. Using its fogSM central management tool, these virtual machines and applications are seamlessly operated by the end user. This approach means a customer's downtime can be reduced from 4 to 5 hours to just a few minutes.

A case in point is illustrated by KUKA Robotics, a leading supplier of Industrial Robots who adopted the Nebbiolo platform and benefitted in the following ways:

- Seamlessly integrated the IT infrastructure to the cloud across disparate networking topologies
- Virtualized legacy applications and ran them without any modifications
- Gained remote monitoring and management of multiple robots
- Established infrastructure to host in-house software applications as well as apps from third parties

Frost & Sullivan recognizes in this case example the importance Nebbiolo places on ensuring superior satisfaction amongst its customers by ushering them into the age of IIoT nearly effortlessly by meeting them where they are, both working with what the customer already has in place and introducing new ways to boost performance, thereby enhancing the ownership experience.

Customer Acquisition

Nebbiolo executes its customer acquisition strategy in two ways. First, it works directly with end users to address their specific issues. Second, it works closely with major system integrators around the world. Frost & Sullivan's industry benchmarking research finds that the differentiating factor here is that while competitors offer vendor-locked-in hardware and software solutions, Nebbiolo's customers can choose either a combination of hardware-software or stand-alone software that is device agnostic.

In 2018, Nebbiolo forged a strategic partnership with Toshiba Digital Solutions Corporation, a leading provider of system integration and digital service solutions. Through this partnership, Nebbiolo supports Toshiba's SPINEX IoT architecture with edge computing capabilities, thereby extending its services to a wider customer base across North America and Europe and Asia Pacific and Japan. In contrast to its competitors, who have a much narrower scope of strategic partnerships, Nebbiolo's partners include global companies such as Dell, Advantech, and Intel. Through these partnerships, Nebbiolo enables end users to modernize their aging fleet of both hardware and software; virtualize their OS; and enhance consolidation, central management, and security of their platform, thereby meeting their exact needs and improving overall efficiency.

Growth Potential

Nebbiolo's growth potential is best exemplified by its strong focus on offering advanced and best-in-class solution features. The company strives to develop innovative products and technologies as well as leverage its service capabilities to enhance its market presence. A key aspect that serves as a differentiator in this market is the company's focus on initiatives that would provide benefits from a long-term perspective. Specifically, Nebbiolo platform integrates machine control, system management, data gateway, software application hosting, and data analytics functions to enable the following features.

Combines the functions of multiple controllers and Industrial PCs, together with newer applications on a single virtualized platform: The uniqueness of this feature is that in contrast to its top competitor's solution, in which the end user has to invest in new hardware and software every time hardware becomes outdated, Nebbiolo's customers do not have to worry about hardware obsolescence, as their CAPEX into software is protected.

Advanced applications: The integrated data analytics platform offers the robust and flexible infrastructure required to host advanced analytics applications, such as predictive maintenance and predictive quality.

Device agnostic: Nebbiolo's fogOS is hardware system agnostic and enables faster control loops, real-time data acquisition, and data analysis.

Cloud or On Premises Centralized Management: The fogSM offers infrastructure to host application and policy management and device configuration either in the Cloud or on-premises. The uniqueness of this feature is that the deployment of new machines becomes much easier, as all parameters for the job are recorded and applied at will. Furthermore, fogSM enables remote monitoring and management of many machines along with secure software upgrades.

Data rights management: Another differentiating feature of Nebbiolo's platform is its data rights management, using which data streams can be segregated between machine builders, end customers, system integrators, and service providers, depending on the requirement.

Frost & Sullivan firmly believes that Nebbiolo, with its innovative edge computing solution and exemplary service capabilities, is likely to grow at a rate of around 10% above the average market growth rate, over the next 3 years.

Brand Equity

Nebbiolo is a respected brand in the IIoT edge computing market and is renowned in the North American region for providing innovative products and services for its customers in a timely manner. While the company has an extensive international presence through its system integrator partners, it is particularly strong in the North American market, from which more than 40% of its overall revenue is generated

Nebbiolo's brand equity is further enhanced by the fact that it is backed by global investors. In contrast to competitors who are backed by traditional venture capitalist firms, Nebbiolo has attracted investments from technology firms such as KUKA Robotics and TTTech. Apart from enabling the company to enhance its brand equity, these investors serve to assist Nebbiolo in achieving its goal of developing innovative product solutions by effectively leveraging their technical expertise.

Conclusion

Nebbiolo's technology streamlines and modernizes legacy OT systems and accelerates digitalization across the manufacturing vertical by offering a new class of IIoT applications and advanced data services for remote monitoring, diagnostics, machine performance optimization, predictive maintenance, and advanced real-time control use cases. Nebbiolo offers an edge computing solution with numerous benefits for both machine builders and plant owners.

In contrast to its competitors who do not support customers that own legacy systems, Nebbiolo supports both outdated and modern systems. To achieve this, its edge computing platform virtualizes and converges customers' hardware and software components to adhere to its mission of transforming industrial systems via edge intelligence through virtualization, centralized management, cybersecurity, and data-driven insights at scale.

For its strong overall performance, Nebbiolo Technologies has earned Frost & Sullivan's 2019 Customer Value Leadership Award.

Significance of Customer Value Leadership

Ultimately, growth in any organization depends on customers purchasing from a company and then making the decision to return time and again. Satisfying customers is the cornerstone of any successful growth strategy. To achieve this, an organization must be best in class in 3 key areas: understanding demand, nurturing the brand, and differentiating from the competition.

Understanding Customer Value Leadership

Customer Value Leadership is defined and measured by 2 macro-level categories: Customer Impact and Business Impact. These two sides work together to make customers feel valued and confident in their products' quality and performance. This dual satisfaction translates into repeat purchases and a lifetime of customer value.

Key Benchmarking Criteria

For the Customer Value Leadership Award, Frost & Sullivan analysts independently evaluated Customer Impact and Business Impact according to the criteria identified below.

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

Business Impact

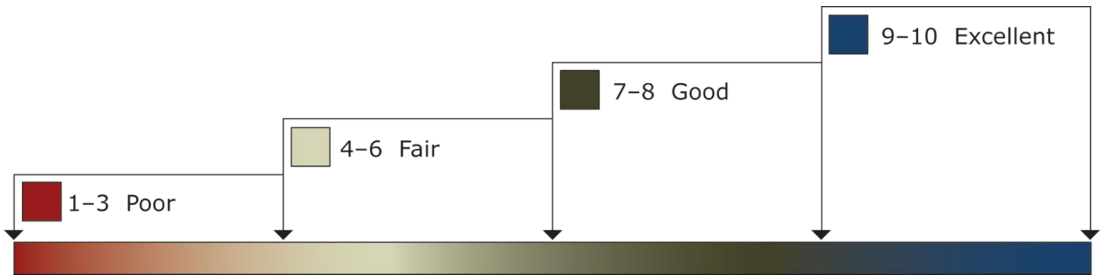
Criterion 1: Financial Performance
Criterion 2: Customer Acquisition
Criterion 3: Operational Efficiency
Criterion 4: Growth Potential
Criterion 5: Human Capital

Best Practices Award Analysis for Nebbiolo Technologies

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 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 considers Customer Impact and Business Impact (i.e., 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, Frost & Sullivan has chosen to refer to the other key participants as Competitor 1 and Competitor 2.

Measurement of 1–10 (1 = poor; 10 = excellent)			
Customer Value Leadership	Customer Impact	Business Impact	**Average Rating**
Nebbiolo Technologies	**9.5**	**9**	**9.25**
Competitor 1	8	8	8
Competitor 2	7.5	7	7.25

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 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.

Business Impact

Criterion 1: Financial Performance

Requirement: Overall financial performance is strong in terms of revenue, revenue growth, operating margin, and other key financial metrics.

Criterion 2: Customer Acquisition

Requirement: Customer-facing processes support the efficient and consistent acquisition of new customers, even as it enhances retention of current customers.

Criterion 3: Operational Efficiency

Requirement: Staff is able to perform assigned tasks productively, quickly, and to a high quality standard.

Criterion 4: Growth Potential

Requirements: Customer focus strengthens brand, reinforces customer loyalty, and

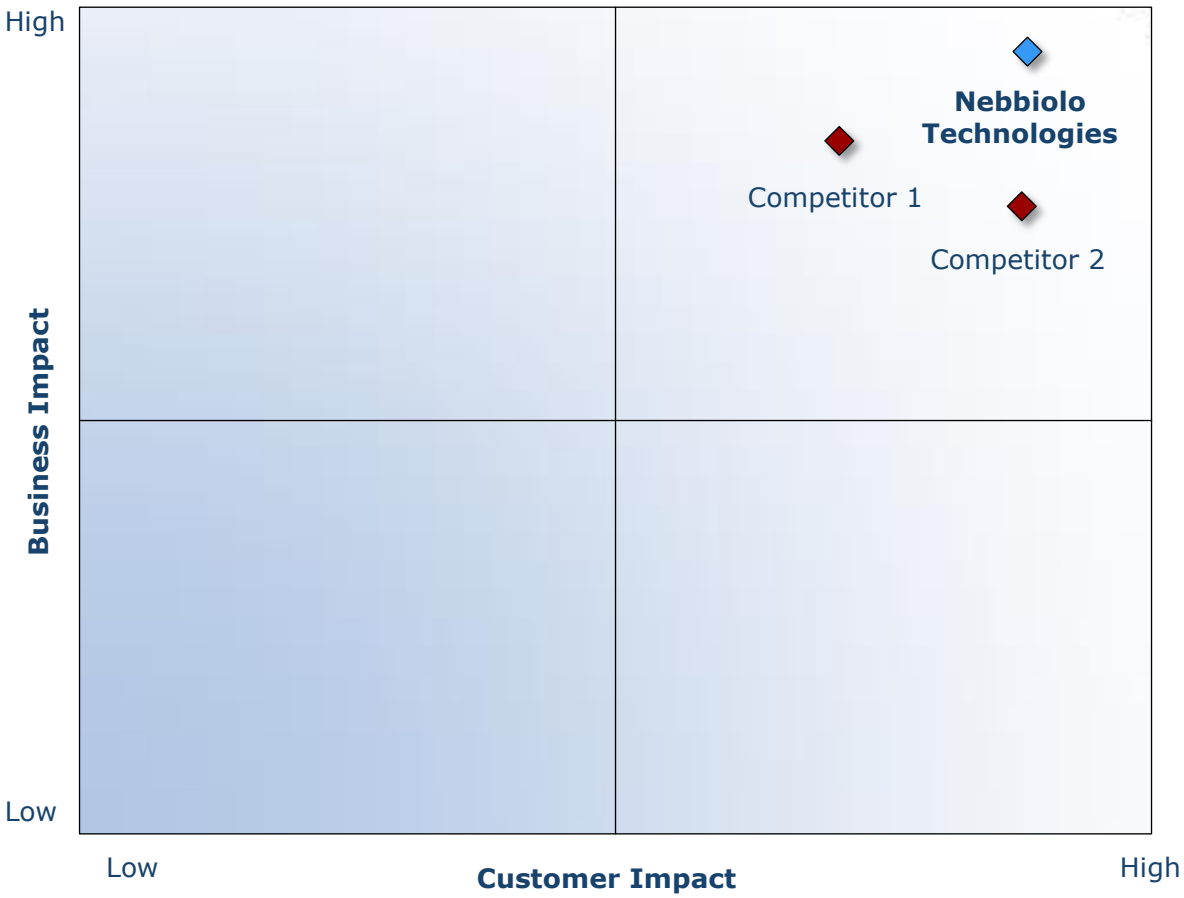
enhances growth potential.

Criterion 5: Human Capital

Requirement: Company culture is characterized by a strong commitment to quality and customers, which in turn enhances employee morale and retention.

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 practices 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 world	• Conduct in-depth industry research • Identify emerging industries • Scan multiple regions	Pipeline of candidates that potentially meet all best practices criteria
2	**Perform 360-degree research**	Perform comprehensive, 360-degree research on all candidates in the pipeline	• Interview thought leaders and industry practitioners • Assess candidates' fit with best practices 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	• Confirm best practices 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	• Brainstorm ranking options • Invite multiple perspectives on candidates' performance • Update candidate profiles	Final prioritization of all eligible candidates and companion best practices positioning paper
5	**Assemble panel of industry experts**	Present findings to an expert panel of industry thought leaders	• 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	• 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	• 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 practices award recipient	• Review analysis with panel • Build consensus • Select recipient	Decision on which company performs best against all best practices criteria
9	**Communicate recognition**	Inform award recipient of award recognition	• 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	• Coordinate media outreach • Design a marketing plan • Assess award's role in 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 the 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, resulting in 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, helps clients 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 practices models to drive the generation, evaluation, and implementation of powerful growth strategies. Frost & Sullivan leverages nearly 60 years of experience in partnering with Global 1000 companies, emerging businesses, and the investment community from 45 offices on 6 continents. To join Frost & Sullivan's Growth Partnership, visit http://www.frost.com.