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BEST PRACTICES

AWARDS

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2020 BEST PRACTICES AWARD



**2020 NORTH AMERICAN EDGE-CENTRIC
AUTOMOTIVE DATA MANAGEMENT SOFTWARE
ENABLING TECHNOLOGY LEADERSHIP AWARD**

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Background and Company Performance

Industry Challenges

As the mobility industry evolves from delivering vehicles with basic safety features to those with Advanced Driver Assistance Systems (ADAS), the current software platforms must take a technological leap so their response time will align instantly with warnings about the vehicle's environment, which is required to prevent accidents, while collecting and computing large amounts of data. Surrounding data captured continuously from sensors, lidars, radars, Li-Fi, and thermal cameras become heavy to transfer using existing technology, causing some discontinuation and loss. Even when the transfer of data is 100% successful, it has to travel to distant servers for computation, after which the output must travel back and proves inefficient for maneuvering instantly while a vehicle is in motion. Moreover, this model requires costly data storage and computation in large hubs.

Ultimately, the ADAS driving solutions available today are not sufficient enough to deliver seamless computing due to unpredictable interruptions in data communication that consequently lower the success rate of making vehicles safer. To overcome these challenges, automakers must remain ahead of innovation and deliver a new way to leverage vehicle safety features that will optimally facilitate interoperability between vehicles, drivers, pedestrians, and road infrastructure. Frost & Sullivan recognizes that to stay ahead of the curve, OEMs and parts suppliers should take advantage of edge-centric software applications that allow seamless data transfer and efficient compute operations.

Most emerging edge-centric software applications are designed to serve various industries. Although variety in applicability is promising, ADAS development, in particular, is significantly critical because it is tied to vehicle safety systems that protect human lives. That said, new software companies offering edge-centric solutions to the intelligent transportation sector, such as smart city and public transportation, are struggling to partner with traditional automotive companies. This challenge is massive because connectivity with personal vehicles is the most important variable in offering 360-degree visibility when developing ADAS systems based on machine learning. Therefore, a company's background in vehicle data management and its assembly of a dedicated, expert team are vital components to offering successful edge-centric software solutions for vehicle fleets.

Frost & Sullivan understands that the right automotive software company will enable its automotive clients to preserve their reputable brand names through delivery of tailored and customized ADAS vehicles, thereby solidifying loyalty from drivers that purchase the next wave of vehicles from them.

Technology Leverage and Customer Impact of Renovo

Founded in 2010 and headquartered in Silicon Valley, Renovo is a software company solely focused on intelligent and AI-enabled automotive data management, particularly for real-time edge-centric applications. From its foundation to date, Renovo remains dedicated to supporting automotive clients. The company is accelerating the

implementation of software platform integration for automakers with consistently superior results to carry them to the next levels of vehicle safety and connectivity.

Commitment to Innovation

Through its comprehensive suite of software dedicated to vehicle data management and learning, Renovo completed several innovation milestones in the decade of its existence. Between 2010 and 2016, Renovo was put on the map by contributing the first all-American ground-up electric supercar, the Renovo Coupe, built in partnership with Shelby American. Even at that early stage, Renovo developed an overall software platform on the vehicle that coordinated data from all internal and external sensors communicating across the vehicle, right down to the infotainment system and robust central compute.

Renovo moved into supplying electric powertrains and software platforms to the MARTY program in 2016, which is run by the Stanford University Stanford Research Team. The program was the first of its kind, wherein a software platform was used for autonomous application and made possible by being built on top of Renovo's software platform. The result was another industry first, this time in the form of the self-driving DeLorean car.

The next expansion of Renovo's software platform was a 100% in-house product in 2017. Initially promoted to the industry as a middleware layer for autonomous vehicles, the platform promised much more than that; rather, it was an end-to-end software platform that connected an advanced vehicle and its data from an individual sensor level, to its central compute, through the edge and ultimately to the cloud. This became a game-changer in the automotive industry, especially in the advanced driver assistance system (ADAS) space, by allowing scaleable, reliable and predictable data transfer from entire vehicle fleets. Also, when used in an edge context, all of a vehicle fleet's data could be processed via AI and ML workloads directly on the edge. Meaning value and learnings could be gleaned from vehicle fleets before data was ever sent to the cloud.

Commitment to Creativity

In 2019, Renovo commercially launched its edge-centric ADAS-focused software platform. This launch positioned it as a pioneering automotive software company delivering an edge-centric, end-to-end automotive data platform. This opened up new solutions of better operability for ADAS feature development teams inside some of the world's largest automotive OEMs. Renovo now offered these teams two main advantages: Cost; by decreasing their reliance on costly cloud storage and compute. And time; providing development teams the opportunity to collect data at the source (the vehicle), processing it there (on the edge) before sending only the most insightful data to the development teams via the cloud.

Application Diversity

Ten years of experience in working on advanced vehicle data management and software, from low-level mechanical systems like batteries and electric motors to advanced software systems like on-vehicle containerized application management and autonomous drive by wire operation, enabled Renovo to offer a comprehensive end-to-end data platform that is flexible in delivering the best ADAS technology giving automotive OEMs the ability to learn

from their vehicles faster than ever before. Renovo's experience operating the most advanced vehicle's many connected parts and systems laid the foundation from which to understand all data within a single vehicle as well as across an entire fleet of globally-distributed vehicles. For a truly edge-centric platform to operate successfully, a full integration of hardware and software is necessary to reimagine the traditional model of automotive systems operating in siloes. Having hardware experience and a deep network of world-class partners across various vehicle components, Renovo gains an edge over its competitors within the automotive software market.

Through its data management platform, Renovo is enabling automakers to improve their vehicles and systems even after the vehicles have been sold. For example: after vehicle launch, ADAS development teams will have the ability to not only improve, but even add functionality to already released ADAS features. Using data collected in the real world, from real driving scenarios, experienced by real customers, an advanced cruise control feature can be improved to better understand and react to the world it encounters. Renovo can identify areas where current versions of the advanced cruise control struggles or disengages unexpectedly, like: closed freeway lanes, construction zones, around traffic cones, or when vehicles within a certain proximity operate strangely. Renovo packages these learnings and deliver them to ADAS development teams who can build and deploy updates that improve vehicle safety, increase feature reliability (decrease disengagements) and provide an overall improvement in the customer experience.

Renovo creates an opportunity for real-life learning experiences that cannot happen on a test track for so many edge-use cases.

This ability for automakers to learn from their vehicle fleets with rich datasets is not limited to just ADAS development teams. Renovo customers use data to inform teams throughout automotive OEMs. Powertrain, reliability, manufacturing, warranty, sales, marketing teams and more have used Renovo to apply real world vehicle data to inform their teams' decision making.

Customer Purchase Experience

Renovo positively impacts large-scale automakers that follow traditional vehicle development processes but want to cut down the 5-year timeline to just 2 years when integrating ADAS software technologies. When following a traditional development cycle, software created over a number of years often becomes inefficient because once the initial vehicle model is launched, all the machine learning gained during development is erased and does not transfer into a newer model of vehicle since the feedback mechanism is not continuous after production. Renovo, in contrast, is continuously learning and supplying feedback to automakers concerning the areas in which end users face problems, including where ADAS can be improved. This agility will have a huge impact on automakers because it helps avoid vehicle recalls that cost billions of dollars and often hugely damage a company's image.

Currently, many vehicles are being developed with face recognition features based off of specific algorithms aided by big data input from human features and facial geometry. The

COVID-19 pandemic, however, has created a population of drivers wearing face masks and thus affecting the face recognition software's ability to perform. This scenario carries the potential risk of product recall for automakers, unless the software is learning and being upgraded accordingly. Otherwise, the ill-performing safety features designed to work through face recognition will create risk and potentially cause accidents, which may result in a recall and a negative reputation for automakers. Frost & Sullivan is impressed that Renovo can easily address all of these challenges within a short amount of time to ensure its customers keep pace with and benefit from the changes happening in the real world.

Customer Ownership Experience

Building on its 10 years of software and automotive experience, Renovo launched its latest advanced vehicle data management platform in June 2019, the automotive edge-centric solution by Renovo attracted many multinational company partnerships and customers. Interest expanded quickly to 4 countries and 3 continents, which reflects Renovo's automotive edge-centric software's unique value proposition for automakers and parts suppliers, a great success for a small Silicon Valley company.

This year at CES 2020, Renovo announced a partnership with Blackberry QNX, currently its base for main operating systems of about 150 million vehicles globally. Together, the companies will develop product cycle efficiency on Blackberry's real-time operating software (RTOS). Adding ADAS and autonomous vehicle features to the main operating systems of millions of cars will open up access to considerable amounts of vehicle data; Renovo will help its automotive customers adjust to an agile learning curve and ensure they are supported by the industry's most robust automotive software development expertise. By guaranteeing security in its advanced vehicle software development, Renovo promises fast, efficient, and cost-saving vehicle feature upgrades for its customers.

Brand Equity

Renovo's accolades have been amassing over the past year, being recognized by industry experts. Its latest software platform version received the prestigious Edison award, chosen by 3,000 business executives globally, rewarded at CES 2020 as the only data management platform commercially available in the ADAS market. This recognition marks a meaningful industry shift: commercialization of Renovo accelerates the design, development and deployment of ADAS vehicle fleets.

Always many steps ahead, Renovo has forged strategic relationships to fortify the success of its platform's operation. With telecommunication giant Verizon as an investor, Renovo has created a strong support mechanism in new technology integration and in providing scalable access to service for its customers, not only today but also once the upcoming 5G infrastructure and networks roll out, which will be essential communication for advanced vehicles. Seagate is another significant partnership with Renovo, providing data storage to ADAS and autonomous vehicle fleets globally. Data storage is another end point in automotive edge computing solutions; so this is a key partnership for the efficient distribution of edge nodes, for offering bundled business models to customers who need either mobile or fixed edge storage options and for helping auto OEMs with their local

storage infrastructure. As a result, with its total support from telecoms, edge-computing and storage ecosystem giants, Renovo is ensuring its customers will be served the highest quality in real-time, low-latency computing and scalable operating capacity for either for one car or an entire globally distributed fleet.

Conclusion

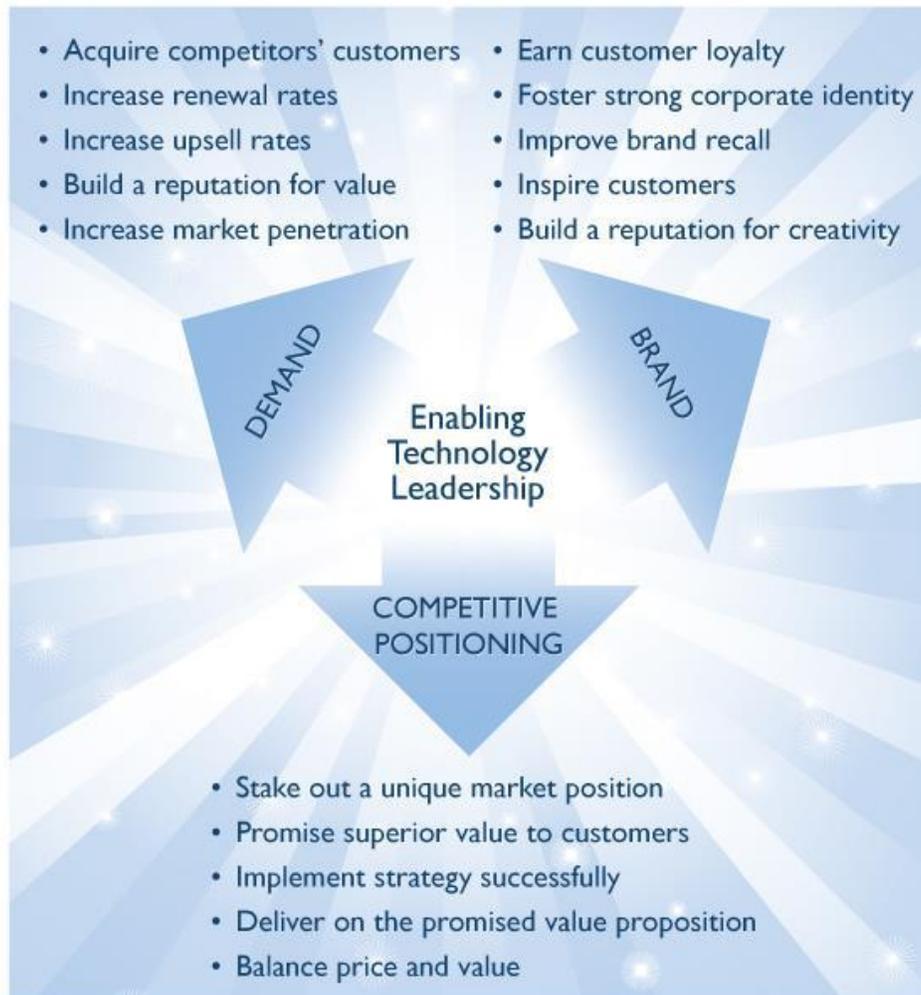
The ADAS driving solutions available today do not deliver seamless computing due to unpredictable interruptions in data communication that consequently fail to make vehicles as safe as they need to be. Frost & Sullivan recognizes the lucrative, accelerated aspects of pairing edge computing data management with ADAS and autonomous vehicles. Advances in this technology are enabling ADAS and autonomous vehicles in general to become commercially available and reduce the chance of accidents.

Renovo has created a remarkable, first-of-its-kind edge-centric data management software platform that offers fast, reliable, and advanced automotive data solutions, a combination of all the vehicle's different systems on a single platform. The company is seeking to redefine the vehicle software development stage through edge technology and value-added partnerships with investors, automakers, Tier I suppliers, and communication companies.

For its strong overall performance, Renovo has earned Frost & Sullivan's 2020 Enabling Technology Leadership Award in the edge-centric automotive data management software market.

Significance of Enabling Technology Leadership

Ultimately, growth in any organization depends on customers purchasing from a company and then making the decision to return time and again. In a sense, then, everything is truly about the customer. Making customers happy is the cornerstone of any successful, long-term growth strategy. To achieve these goals through enabling technology leadership, an organization must be best in class in three key areas: understanding demand, nurturing the brand, and differentiating from the competition.



Understanding Enabling Technology Leadership

Product quality (driven by innovative technology) is the foundation of delivering customer value. When complemented by an equally rigorous focus on the customer, companies can begin to differentiate themselves from the competition. From awareness, to consideration, to purchase, to follow-up support, organizations that demonstrate best practices deliver a unique and enjoyable experience that gives customers confidence in the company, its products, and its integrity.

Key Benchmarking Criteria

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

Technology Leverage

- Criterion 1: Commitment to Innovation
- Criterion 2: Commitment to Creativity
- Criterion 3: Stage Gate Efficiency
- Criterion 4: Commercialization Success
- Criterion 5: Application Diversity

Customer Impact

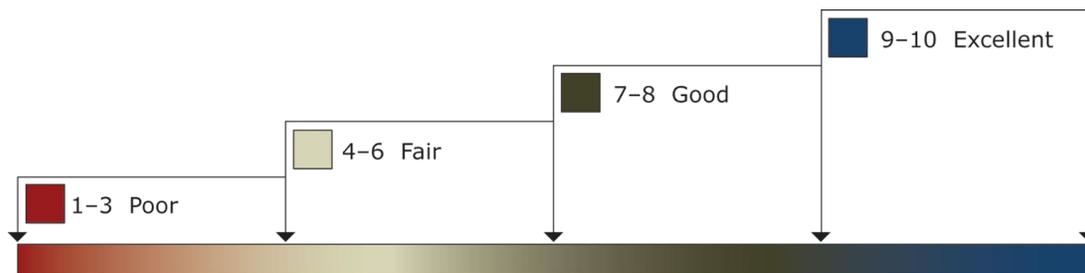
- Criterion 1: Price/Performance Value
- Criterion 2: Customer Purchase Experience
- Criterion 3: Customer Ownership Experience
- Criterion 4: Customer Service Experience
- Criterion 5: Brand Equity

Best Practices Award Analysis for Renovo

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 Technology Leverage and Customer 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.

<i>Measurement of 1-10 (1 = poor; 10 = excellent)</i>			
Enabling Technology Leadership	Technology Leverage	Customer Impact	Average Rating
Renovo	9.8	9.0	9.4
Competitor 1	8.1	7.3	7.7
Competitor 2	7.6	6.8	7.2

Technology Leverage

Criterion 1: Commitment to Innovation

Requirement: Conscious, ongoing adoption of emerging technologies that enable new product development and enhance product performance.

Criterion 2: Commitment to Creativity

Requirement: Technology leveraged to push the limits of form and function in the pursuit of white space innovation.

Criterion 3: Stage Gate Efficiency

Requirement: Adoption of technology to enhance the stage gate process for launching new products and solutions.

Criterion 4: Commercialization Success

Requirement: A proven track record of taking new technologies to market with a high rate of success.

Criterion 5: Application Diversity

Requirement: The development and/or integration of technologies that serve multiple applications and can be embraced in multiple environments.

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

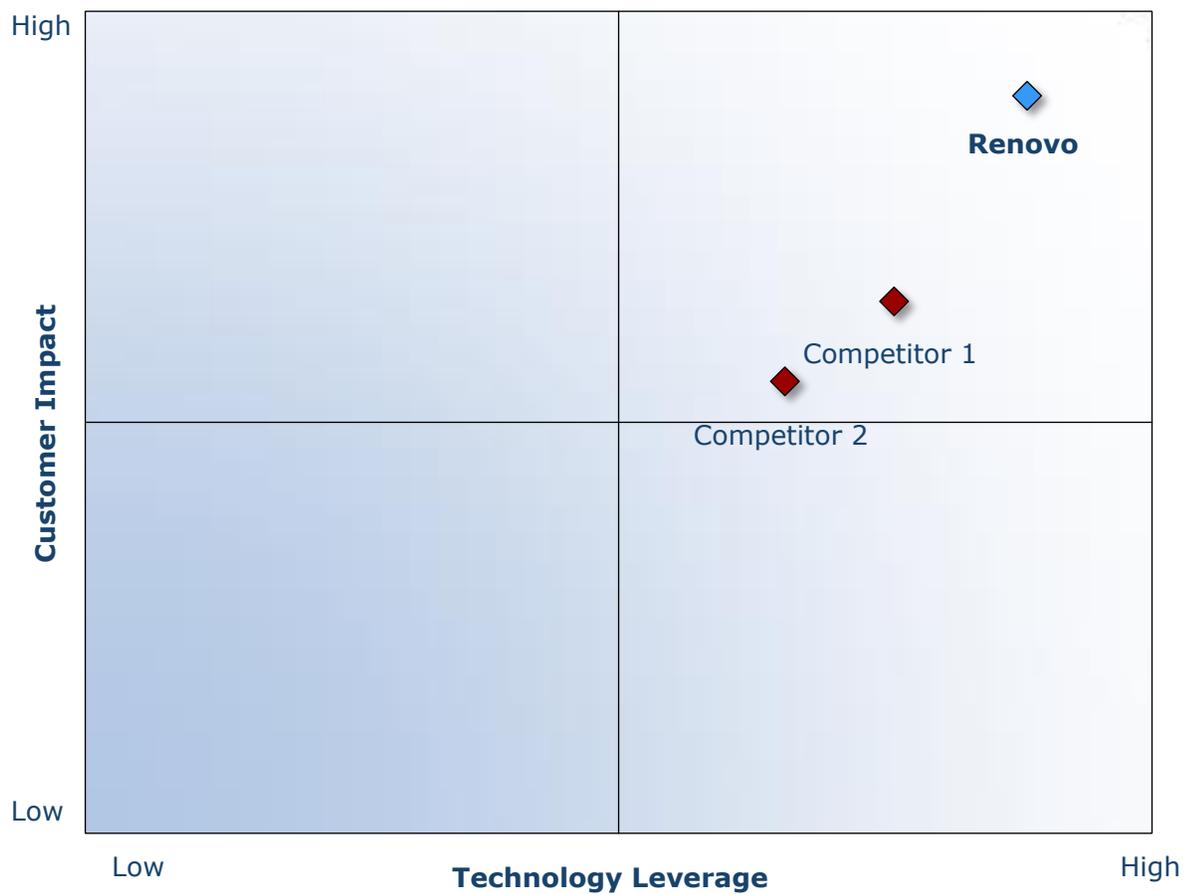
Requirement: Customer service is accessible, fast, stress-free, and of high quality.

Criterion 5: Brand Equity

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

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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<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 practices 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 practices 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 practices criteria
9 Communicate recognition	Inform award recipient of recognition	<ul style="list-style-type: none"> • Announce 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 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.



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>.