FROST & SULLIVAN

YOKOGAWA

2017 Global
Automation Solutions and Services
Customer Value Leadership Award

Contents

Background and Company Performance

Industry Challenges

The primary global trends that are disrupting, collapsing, and transforming the process automation markets include Industrial Internet of Things (IIoT), uncertainty in operations/commodity prices, impact of advanced software technology, shifts in demographics and demand. These trends are driving the need for sustainable business performance with certainty in operations (e.g., business, production, manufacturing, supply-chain). This is especially true of process automation industries, which are at an interesting juncture. There are four major shifts happening in this market that are challenging global process automation end users:

- An aging workforce and need for reliability: Nearly 35% to 40% of the process automation workforce is eligible for retirement over the next 5 years.

- Digitization and cybersecurity: End users are willing to connect assets over the Internet in order to realize better asset performance, but are restrained by the security threats.

- Operational efficiency: Volatile commodity price swings are forcing companies to take drastic measures to maintain baseline performance efficiency.

- Asset reliability: Competitive pressure and an acute focus on margins have driven end users to shift from traditional reactive asset management models to predictive and preventative asset management models.

These challenges are driving a state of uncertainty in the end-user mindset, as they are often not aware of a solutions roadmap, implementation strategy, and possible outcomes. The market is also shifting from request for quote (RFQ) projects to proactively shaping and creating new market opportunities/demand. This market shift is driving a change in the sales-to-cash cycle for automation solution providers. Typically, automation companies (like Yokogawa) were selling tangible products such as control systems, safety systems, sensors, flow meters, plant management software, and associated services. However, the digital shift signals the need for automation solution providers to educate end users on areas of opportunities and will thereby drive new market development. Automation companies usually use a consultative approach, utilizing a team of consultants to discover and advise on plant operations-related issues and advise customers on the best approaches that can be taken by them.

Yokogawa, one of the few independent automation companies, is primarily focused on the energy value chain (oil and gas—upstream, midstream, and downstream chemicals, petrochemicals, refining, and power generation). Keeping with the market trends, the company is also transforming in order to drive incremental business value to its global customer base. One of the ways that the company has transformed is through strategic acquisitions (e.g., Industrial Evolution, Inc.; KBC Advanced Technologies plc; Soteica Visual Mesa, LLC). Further, Yokogawa is looking to intensify market participation in existing and near-adjacent industry verticals, primarily in areas where it currently has minimal presence (e.g., mining and power transmission).

Customer Impact and Business Impact

Customer Ownership Experience

Because process and hybrid end users (end users include oil and gas, chemicals, refining, food and beverages, and life sciences) are faced with shrinking CAPEX investments, they now have to optimize their lifecycle operations expenditure. Further, a cross section of end users (mentioned above) also face other critical issues such as digitization, security threats, competitive pressures, and margin security. At this point, it is imperative for solution providers to reposition themselves from a product supplier to solutions and service supplier. Automation companies will need to offer value-added services such as human capital management, asset management services, plant design services, simulation, and production analytics. Further, end users are looking for trusted industry solution partners that can continuously diffuse best practices learned from near-adjacent industry verticals and evolve with maturing technology landscapes.

Competition in the process automation market is driving companies to increase solution service capabilities. Several companies are inorganically growing this capability while a few are using an organic model to bolster solution capabilities, initiating a race to become the anchor in the industrial markets. Although there are multiple solutions available in the market to address the customer/end-user challenges, it is important to structure an end-to-end solution that comprehensively addresses the value-delivery model from the phases of plant design, engineering, commissioning, asset management, human capital management, and lifecycle operational sustainment.

Yokogawa, one of the few independent automation solution providers, differentiates itself in this market in many different aspects. The company recently made a series of strategic acquisitions to differentiate its breadth and depth of capabilities. The acquisitions were:

- Industrial Evolution, Inc. (acquired in December 2015): This Company is a pioneer of secure cloud-based data sharing services in energy and chemical industries, since the year 2000. It is one of the most well-known companies in the market and services a number of Fortune 100 companies who leverage its data collection and sharing services. This acquisition helps strengthen and expand Yokogawa's advanced solutions portfolio for process industries. Yokogawa's advanced solutions portfolio already includes solutions such as advanced process control, simulation, and process information management system. Further, the acquisition will allow Yokogawa to deliver Data-as-a-Service platform capabilities to its existing installed base. Yokogawa is enhancing its cloud-based advanced solution business based on the technology of Industrial Evolution. In February 2016 Industrial Knowledge was established as a business unit to enhance the cloud-based advanced solutions business based on the technology of Industrial Evolution.

- KBC Advanced Technologies Limited (acquired in April 2016): This company has been focused on improving operational excellence and profitability in the upstream and downstream segments of oil and gas. The acquisition allows Yokogawa to gain a differentiated blend of advanced software and operational consulting capabilities. This fills a gap in the portfolio, which positions Yokogawa as a comprehensive

solution provider from the C-suite office to the plant-level operator.

- Soteica Visual Mesa, LLC (SVM) (acquired in October 2016): This acquisition allows Yokogawa to gain energy management capabilities, production accounting, and scheduling for process industries.

Yokogawa's current solutions and service are technologically unparalleled offerings, and these are further amplified by its acquisition of KBC Advanced Technologies Limited and Industrial Knowledge, as explained above. These strategic acquisitions help Yokogawa drive differentiated customer value by discovering areas of improvement, automating the manufacturing processes, sustaining these benefits, and driving continuous improvement. The primary objective of Yokogawa's comprehensive solution and service offering is to increase the return on capital employed (ROCE) while reducing operational performance variability. The adoption of a comprehensive solution, like the one provided by Yokogawa, helps process automation end users drive smarter, faster, more responsive, and more profitable operations.

Best Practices Example: As per Yokogawa's Transformation 2017 plan, it aims to leverage its best-in-class measurement, control, and information technologies with KBC's advanced software and Industrial Evolution's data sharing capability to drive strategic business value and facilitate the realization of potential synergies for its customer base. The customer-centric experience created by Yokogawa is already being well received by customers, according to the company.

Customer Service Experience

As of 2017, technology refresh cycles have been halved when compared to the past decade. This trend has forced many large-, mid-, and small-sized companies to tactically look at using outsourced services/managed service offerings. This is driven by the fact that technology investments made by end users are not on par with the market movements. End-user companies look for harmony between operational technology (OT), information technology (IT), and lifecycle management. Because of this, solution providers are expected to demonstrate excellence across these three areas in order to achieve a preferred vendor status with end users. While maturity levels of process automation end users vary, Yokogawa's ability to understand the industry-specific needs of these customers/end users helps it deliver customized solution offerings.

Best-practice: Yokogawa developed a solution called Process Data Analytics to detect process quality issues early on in the manufacturing process through analysis of process data, material quality data, operations history, and resources used. The solution's strength is proven by the fact that Yokogawa has over 100 contracts to date and continues to improve on the solution capabilities. The ability to comprehensively analyze the inter-dependencies between man, material, and machines, demonstrates the customer service capability of Yokogawa. The process data analytics solution can be used to monitor and maintain production quality control across industries such as oil and gas, petrochemicals, chemicals, iron, steel, pharmaceuticals, and food and beverages.

Another solution that speaks volumes of Yokogawa's customer-centricity, innovative

capability and technology ingenuity is the industry-leading distributed fiber optic sensing solution. It provides thousands temperature measurement points in minutes which is ideal for well monitoring, pipeline leak detection, fire detection, power cable monitoring, or other large production facilities. Thus improves operational safety, availability and efficiency. This solution currently includes two main products - DTSX200 and DTSX3000. The differentiation is its integrated industrial modular design with longest distance, up to 50 km and highest performance. Such capabilities are beneficial to facilitate reliable measurement in harsh environment which was never realized in the past. Oil and Gas, and other customers continue to adopt these cutting-edge distributed fiber optic sensing solutions in various applications.

Brand Equity

Yokogawa recently celebrated its 100-year anniversary. The company is one of the few independent automation companies primarily focused on the energy and chemical value chain. While the company is aggressively building its presence in the United States, it is one of the top 3 companies in Asia-Pacific, Middle East, and Europe. Yokogawa has successfully created a strong brand in the process automation market that is based around its proven MAC (Main Automation Contractor) capability, project execution and technology prowess, and focus on the customer. This is evident from the fact that several large integrated oil and gas companies like Shell, Gazprom Neft continue to renew long-term contracts. Case in point, Yokogawa recently signed an agreement to start an International Center for Innovation in Russia. This is primarily to drive the development of advanced solutions for Gazprom's refineries. This particular example showcases end-users perception towards Yokogawa's technology and brand.

To further amplify its brand awareness, Yokogawa has collaborated with Microsoft Corporation; FogHorn Systems, Inc.; Bayshore Networks, Inc.; and Telit IoT Platforms, LLC to synergize market offerings with combined technology platform offerings. Yokogawa also setup its IIoT architecture development division on the West Coast of the United States to create a robust, next-generation, and flexible architecture. Yokogawa will use this division to collaborate more closely with its partners and subsequently develop innovative solution offerings.

Customer Acquisition and Operational Efficiency

Providing a blend of technology excellence and services is required in current industrial markets. While many competitors have strengths in specific value-chain segments, Yokogawa's integrated value proposition allows it to effectively serve end users from an end-to-end perspective. For example, KBC Advanced Technologies Limited is able to offer facility simulation, reactor models, pipeline simulations, flow modeling, and fluid modeling in addition to value-added consulting services designed specifically around the end user's business to improve operational and employee performance. In order to provide more value to customers, KBC has introduced a new solution – KBC Co-Pilot Program[TM]. The solution takes a drivers-seat approach to help plant owners and operators achieve optimum performance. It is a secure cloud-based remote unit performance monitoring and optimization service that constantly measures plant performance against planned KPI's.

This helps plant operators in identifying and implementing opportunities to improve performance and reduce performance variability. As customers look to scale and connect multiple plants globally, solutions like KBC Co-Pilot Program™ will help them benchmark plant performance and drive optimal business performance. The roadmap of the KBC Co-Pilot Program™ solution is two-fold. Today, it offers remote monitoring and production optimization. 2018 and beyond, the plan is to offer energy management, supply-chain and operator effectiveness.

Further, local service centers are strategically located in areas throughout Europe, Asia-Pacific, Latin America, and the United States so the company can quickly meet client requirements. Yokogawa has about 4,000 project engineers, 2,000 service engineers, and 1,200 software consultants across 59 countries across the world. It has managed over 44,000 projects worldwide since the start of the company. The global reach of the company, with local delivery capabilities, is a standard requirement within the automation market.

The comprehensive ability to single-handedly drive step changes in operational efficiency parameters by using class-leading technology solutions and service capabilities has given Yokogawa the potential to become an industry standard.

Growth Potential

The Industry Automation (IA) business vision of Yokogawa is to become the most trusted partner and drive sustained operational performance improvements for customers in the energy and chemicals value chain. This vision statement from IA is very timely, because it is poised to deliver solutions to customers who are currently confused by several technology convergences and volatility issues. The customer opportunities are across two specific areas:

- **Shift from site-level optimization to enterprise-scale optimization:** End users are faced with shrinking workforces and are thereby driven to standardize solution deployment across their enterprises. Leading companies are quickly shifting focus from site-specific pilot implementation to enterprise-scale predictive performance optimization. Frost & Sullivan has observed that several companies (e.g., large integrated oil companies, chemical majors, specialty chemical manufacturers, power generation utilities) are adopting long-term solutions and service agreements with one unified solution provider. This offers a strong growth potential for Yokogawa, as it is positioning itself as a trusted partner that can address all these challenges.

- **Open standards use:** Many of the energy and chemical end users are drastically changing their operational models due to their frustration with traditional hard-lined relationships with solutions and service providers. A leading integrated oil company has embarked on a journey to use standards-based hardware for control systems operations. This has severe implications to the process automation industry, as it has typically used proprietary protocols. However, Yokogawa stands to significantly benefit from this trend because the company's long-standing focus has been on open standards. This is further resonated by the fact that Yokogawa

has already taken its first step towards developing an open-architecture, which allows systems to be interfaced without the need for a Vnet/IP card. Additionally, the Vnet/IP which is a real-time plant network system for process automation based on the 1-Gbps Ethernet communications system is in accordance with IEC 62405 to ensure compliance with security requirements. Yokogawa is also developing open architecture-based solutions to achieve optimization in the process industry. Further, the organization is also actively pursuing the development of comprehensive security management solutions for mission critical control systems by forming strong partnerships with IT companies like Cisco and McAfee. This is further strengthened by the development of the SecurePlant initiative. This is a comprehensive security management solution to be deployed in over 50 Shell plants globally.

As the market steers towards change, Yokogawa is well positioned to capitalize on the growth opportunities provided.

Conclusion

Yokogawa's vision has not wavered for the past 100 years, and that is its focus on customer excellence. This has been further amplified by strategic acquisitions (Industrial Evolution, Inc.; KBC Advanced Technologies plc; Soteica Visual Mesa, LLC), which position the company as a global leader in the advanced solutions market for the process automation industry. As industrial architectures shift from layered/hierarchical to networked/flat architectures, the ability to innovate and reduce performance variability is further enhanced. However, customers will not be able to do it all by themselves due to the aging workforce, limited technical capability, and cost pressures. This is where Yokogawa is able to seamlessly deliver profit-impacting solutions and services while addressing the aspects of operational safety, stability, productivity, and enterprise resilience. With its strong overall performance, Yokogawa Electric Corporation has earned Frost & Sullivan's 2017 Customer Value Leadership Award for Automation Solutions and Services market.

Significance of Customer Value Leadership

Ultimately, growth in any organization depends upon customers purchasing from a company and then making the decision to return time and again. Delighting customers is, therefore, the cornerstone of any successful growth strategy. To achieve these dual goals (growth and customer delight), an organization must be best-in-class in three key areas: understanding demand, nurturing the brand, and differentiating from the competition.

- Shift competitors' customers
- Increase renewal
- Increase upsell
- Customer value
- Increase market penetration

- Increase equity
- Improve recognition/recall
- Inspire customers
- Value leadership
- Clarify value proposition

DEMAND

BRAND

Customer Value Leadership

COMPETITIVE POSITIONING

- Clarify superior positioning
- Superior value to customers
- Competitors fall behind
- Best implementation
- Value mapping

Understanding Customer Value Leadership

Customer Value Leadership is defined and measured by two 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 long shelf life. This dual satisfaction translates into repeat purchases and a high lifetime of customer value.

Key Benchmarking Criteria

For the Customer Value Leadership Award, Frost & Sullivan analysts independently evaluated two key factors—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 Yokogawa

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

9–10 Excellent
7–8 Good
4–6 Fair
1–3 Poor
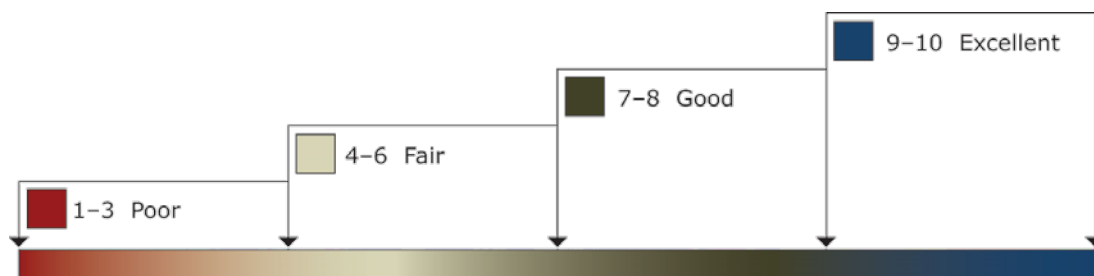
The Decision Support Scorecard is organized by Customer Impact and Business Impact (i.e., These are the overarching categories for all 10 benchmarking criteria; the definitions for each criterion are provided beneath the scorecard.). The research team confirms the

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.

Measurement of 1–10 (1 = poor; 10 = excellent)			
Customer Value Leadership	Customer Impact	Business Impact	**Average Rating**
Yokogawa	**9**	**9.5**	**9.5**
Competitor 2	8	8.5	8.5
Competitor 3	7	8.5	7.5

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.

Business Impact

Criterion 1: Financial Performance
Requirement: Overall financial performance is strong in terms of revenues, 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.
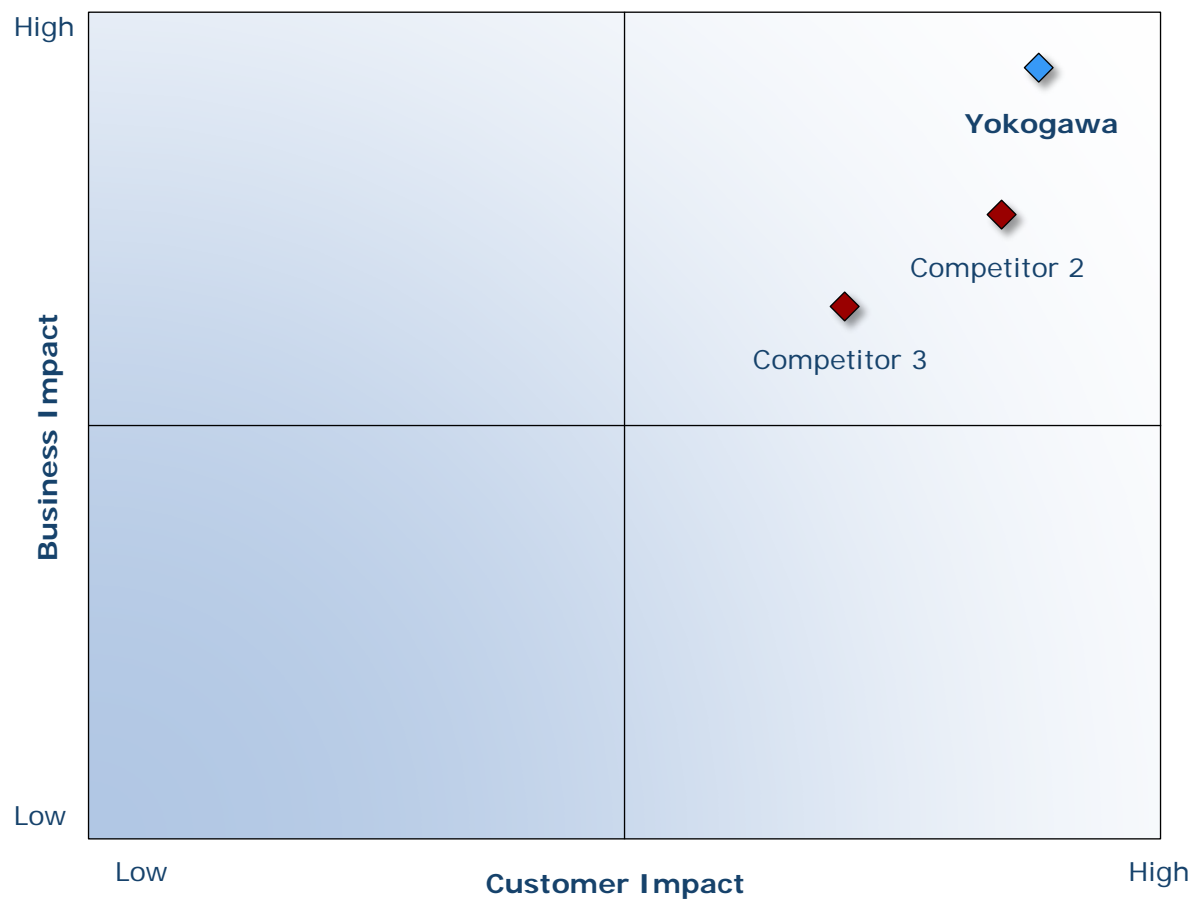
Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices

Frost & Sullivan analysts follow a 10-step process to evaluate Award candidates and assess their fit with select best 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	• 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	• 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	• 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	• 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	• 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-practice Award recipient	• 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	• 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 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.