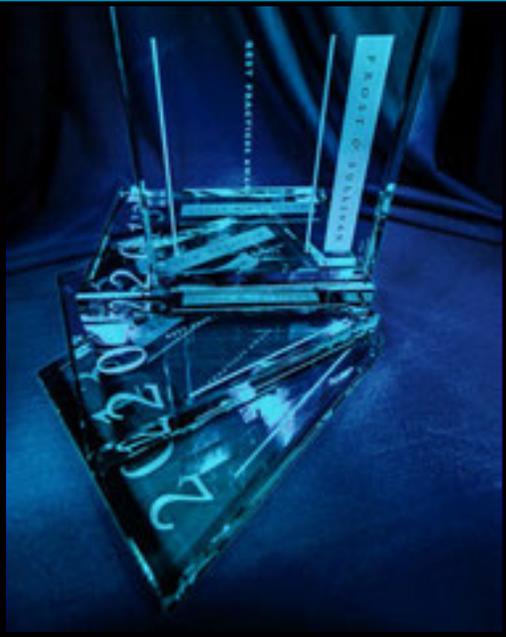




2016 Sub-Saharan African
Water and Waste - Water Treatment
Enabling Technology Leadership Award



2016
BEST PRACTICES
AWARDS

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Background and Company Performance

Industry Challenges

The water and wastewater treatment market in South Africa was valued at \$148.9 million in 2013 and is predicted to reach \$176.4 million in 2018, at a compound annual growth rate of 3.5%. Municipalities and industrial sectors such as mining, food and beverages processing, and oil and gas extraction are the key users of water and wastewater treatment technology.

Water scarcity is a major problem in South Africa. Although the Department of Water Affairs (DWA) stringently protects water reserves – and new technologies have been adopted – water pollution continues to be a concern. Most critically, acidic effluents from mining environments, known as acid mine drainage, are contaminating more than two-thirds of South Africa's water reserves. Water treatment technologies are crucial in providing a solution for the recycling, reuse and recovery of water from contaminated water bodies. However, these technologies require extensive planning and funding before they can be implemented.

Three key challenges facing the industrial water and wastewater treatment industry are: a lack of funding for innovative projects, a lack of safe disposal methods for the salts removed from the effluent, and the uncontrolled discharge of contaminants back into water reserves. Innovative water and wastewater treatment technologies often require funding for applied research. This poses a serious challenge, as new technologies are often not easily accepted by big industry, which is set in its ways.

Many industrial water and wastewater treatment plants have adopted thermal zero-liquid discharge (ZLD) technologies that use a combination of ultrafiltration, reverse osmosis, and evaporation/crystallisation units to recover clean water from contaminated water sources. The unit operations, constituting a ZLD technology plant, are crucial in determining operational costs, energy consumption and operational efficiency.

The term zero-liquid discharge is used to emphasise that virtually all of the water is recovered and reused in subsequent processes; therefore, no liquid wastes are discharged into the environment. The recovery and reuse of water results in a brine stream which can be further concentrated into solid waste in the form of salts. Water reuse and recycling decreases plant costs and increases operational efficiency; however, the remaining solid waste – concentrated as salts – is often disposed back into mining landfills or stored within the production facility. This leads to potential threats to the environment as these contaminants can harm the fauna and flora surrounding the industrial or mining site as well as contaminate neighbouring water bodies.

Technology Leverage and Customer Impact

“Established in 1986, PROXA is a specialised water treatment solution provider of sustainable water services within the municipal, industrial and commercial sectors. PROXA is active throughout a number of regions with a particular focus on Africa, Latin America, the Middle East and Australia. PROXA’s range of services cover the entire water cycle from consulting and design, research and development, engineering and construction, and plant modernisation to operational management, maintenance, repairs, after-market service, chemicals, consumables, and spares. Its solutions are optimal, reliable and efficiently implemented, while its in-house expertise, extensive research and access to leading global technologies enable the company to deliver objective solutions tailored to address the client’s unique set of needs.”

Commitment to Creativity

PROXA is dedicated to providing water and wastewater treatment solutions that cover the entire value chain from treatment plant design, construction, financing, operation and maintenance, to the management of products, by-products and secondary wastes from a facility.

Increasingly stringent environmental laws imposed by the Department of Water Affairs (DWA) and the Department of Environmental Affairs (DEA) make it necessary for water and wastewater treatment technology providers to find ways to reduce carbon and greenhouse emissions, reduce energy consumption, and stay within the environmental waste discharge limits.

In order to enable its customers to abide by the above-mentioned regulations, PROXA has adopted thermal and non-thermal ZLD technologies for treatment plants that recover more than 99% of water from contaminated water sources. This is opposed to the industry standard of 85 - 95%. The recovered water can then be recycled and reused by other processes thereby minimising the use of municipal and natural water resources. It also increases operational efficiency and simultaneously reduces costs and prevents the discharge of wastewater back into the environment.

Typically, evaporative technologies are the industry workhorses used to achieve ZLD objectives. However, capital and operational costs are determined by the choice of technology and energy source, as well as the feed stream composition.

PROXA’s commitment to creativity is evident in the development of non-thermal as well as non-evaporative ZLD plant technologies that reduce the complexity, lifecycle cost and deployment time of such installations. The company’s technology development follows an evolutionary path as illustrated by a series of installations ranging from traditional evaporative technologies in 1999 to ZLD installations in 2012 that completely eliminate thermal and evaporative technologies. A number of plants are currently in operation and

clearly demonstrate PROXA's continued commitment to development and the evolution of its designs to address client's environmental and business needs.

In 2011, PROXA designed and commissioned the first ever true non-thermal ZLD mine water treatment facility in the world. The plant was installed at Anglo American's Greenside Colliery. Anglo American is a client known for its progressive thinking when it comes to environmental protection and water treatment. PROXA's technology – described as the CASCADE process – is now proven at full scale and was subsequently adopted by other mining majors such as Glencore and Exxaro, among others.

In recent years, PROXA started work on low temperature salt recovery technologies, including Freeze Desalination (FD) and Eutectic Freeze Crystallisation (EFC). In developing these technologies, PROXA drew on its on extensive know-how embedded in its thermal technology subsidiary, Process Plant Technology (Pty) Ltd, as well as the University of Cape Town's Unit for Crystallisation.

Low temperature thermal technologies work below 5 degrees Celsius, compared to evaporative technologies, which operate above 65 degrees Celsius. The technology allows the crystallisation of salts and ice within a settling reactor. The ice and salt crystals differ in density, thus allowing separation. Ice crystals with a low density float at the top of the reactor and can be removed. Salt crystals, on the other hand, possess a higher density and sink to the bottom of the reactor from where they are harvested. Freeze crystallisation is inherently a highly efficient purification step, which enables the salts within the brine stream to be extracted at high purity. This enables PROXA to extract commercially viable salts that can be sold to industrial stakeholders.

PROXA's timely launch of technologies that methodically address industry challenges and provide solutions which are in-line with the transforming needs of the water and wastewater treatment industry, demonstrate that the company has, once again, and delivered on its commitment to creativity and its commitment to always asking one key question: How can we do it better?

Price/Performance Value

PROXA's innovative low temperature freeze desalination and eutectic crystallisation technologies are able to treat mixed salts within the brine stream so that the salts can be differentiated and extracted at high purity. The technology is superior to other water and wastewater treatment technologies because it requires less energy to operate, can be constructed from non-exotic materials and does not require extensive maintenance strategies. A variety of salts can be extracted from mixed brines at purities in excess of 99.5% including sodium sulphate, phosphate salts, calcium carbonate, and others. These by-products can be used in construction, detergents, and fertilizers to mention a few. In contrast to traditional and competing technologies, the combination of lower capital and operating cost with recovery of valuables from waste streams using low temperature processing, allows PROXA's clients to establish sustainable environmental solutions.

Commercialisation Success

According to Frost & Sullivan's research, PROXA excels at providing solutions for the entire water cycle through its launch of innovative technologies that offer solutions to different parts of the water cycle. For instance, zero-liquid discharge technologies treat the contaminated water body to recover pure water; computer solute modelling software controls the water chemistry to remove toxic solutes from the brine stream prior to the concentration and disposal of salts and the CASCADE process does away with thermal technologies for ZLD processes; while the FD & EFC technologies extract pure salts from the brine streams which have commercial value. Therefore, when designing water and wastewater treatment plants that treat different effluents, PROXA excels in process robustness and operational flexibility enabling it to meet the needs of its clients.

Approximately 70% of clients require bespoke plant designs while a standard range of plants are available to accommodate similar feed streams and product output. Working from six international offices, PROXA's solutions and products are operational throughout Australasia, the Middle East, Africa and Latin America.

The company made its mark across the African continent. To date, PROXA operates plants at full scale across South Africa, Zambia, Mozambique, Zimbabwe, Tanzania, Ghana, Namibia, and Botswana.

The commercialisation of plants incorporating the low temperature technology has been successful. PROXA is currently the only company running a plant with this technology at full scale. This technology has enabled PROXA to extract 40 tons/day of a salt that can be used in detergents, the metals processing industry, neutralisation and other applications. Exportable designs are currently being developed.

Stage Gate Efficiency

In developing and adopting game-changing solutions, such as the Low Temperature Treatment technology, a strict process from the development of the technology through to its commercialisation is followed. To start the process, a select group of research and development employees monitor the industry for new technological opportunities. Once a gap in the market is identified, engineering experts design a range of prototype technologies to fill the gap. The second stage involves a technology evaluation screening which appraises the proposed approaches. This stage considers the risks, opportunities, and costs involved in launching the technology. Opportunities are ranked and unsuccessful projects are rejected or shelved. The third stage is the gate approach, which ensures that project deliverables are conducted at a specific time. During this stage, the technology is re-evaluated according to its innovation and commercialisation potential. Upon completion of the evaluation funds are assigned for the next stage. Overall, the complete process can take between 6 months and 6 years before the new solution is launched.

The advantage of this strict selection process is that successful technologies are chosen based on whether they can be used in a wide range of sectors – should they not be successful during the commercialisation of their original purpose. This enables PROXA to innovatively design technologies and ensure they have wide applicability.

The EFC technology was developed in partnership with academic institutes such as the University of Cape Town among others. This offered PROXA the opportunity to obtain reliable data and gain confidence in the proof of concept of the technology's ability to purify salts. The EFC technology proved to be applicable in wastewater originating from numerous sectors. In addition, it can be used to treat both concentrated and dilute brine streams, thereby demonstrating its wide applicability.

Customer Service Experience

PROXA engineers implement the water treatment solution on behalf of their clients using a wide offering of contractual agreements. These agreements enable the company to plan, build, monitor and facilitate plants on behalf of its clients. In addition, PROXA offers the option of maintaining existing plants that clients may already have. This empowers PROXA to build relationships and to renovate clients' plants to reflect best practices, which have a positive impact on the environment. Competitors often offer limited services, such as providing only the design and construction of the plant, which means clients incur additional costs for long-term operation and maintenance.

PROXA maintains plants by using a remote monitoring system known as Q-Trak that continuously monitors the equipment and plant. This means that PROXA offers efficient and best-in-class service while controlling the rate of equipment repair and wear which contributes to decreasing costs for the long-term running of plants. Q-Trak further enables PROXA to enhance the deployment of skilled operational and maintenance staff, which in turn reduces costs.

Brand Equity

Providing value to the client is at the centre of PROXA's technological innovations. PROXA is known for its range of technologies that provide solutions for the client for short-, intermediate-, and long-term use. The company has a well-recognised brand across Africa and competes globally – in Europe, Australia, Latin America and the Middle East – and locally in South Africa, Zambia, Mozambique, Zimbabwe, Tanzania, Ghana, Namibia and Botswana. Over the years, PROXA has grown and adapted its water and wastewater treatment technologies to be applicable in numerous industries ranging from mining, food and beverages, petrochemicals, pulp and paper, power, and steel, and the company remains a water and wastewater treatment technology game-changer. Its partnerships with companies that offer technological engineering solutions have enabled PROXA to expand its customer acquisition and brand equity. Its wide service offering in consulting and design, research and development, and engineering and construction makes the company a leading solution provider in the market.

Conclusion

PROXA's dynamic service offering combining state-of-the-art technologies, advanced computer modelling, management and maintenance strategies as well as on-going research & development demonstrate PROXA's commitment to providing solutions for the entire water cycle. Commercialisation of game changing mine water treatment technologies utilising both non-thermal, as well as low temperature freeze technologies, confirms PROXA as a key participant in the water and wastewater treatment industry. By adhering to industry standards and developing technologies that have diverse technological applicability and are tailored to clients' needs, PROXA is able to extend application of its know-how to different market sectors in various geographical locations. The development of the CASCADE, FD and EFC technologies enable the company to provide a complete solution for water and wastewater treatment and offer a robust strategy for the purification of salts recovered from the brine stream into commercially viable products.

With its strong overall performance, PROXA has earned Frost & Sullivan's 2016 Enabling Technology Leadership Award for water and wastewater treatment.

Significance of Enabling Technology Leadership

Ultimately, growth in any organisation depends upon customers purchasing from your company, and then making the decision to return time and again. In a sense, then, everything is truly about the customer – and making those customers happy is the cornerstone of any long-term successful growth strategy. To achieve these goals through technology leadership, an organisation 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, best-practice organisations 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 two key factors – 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: Commercialisation Success
- Criterion 5: Application Diversity

Customer Impact

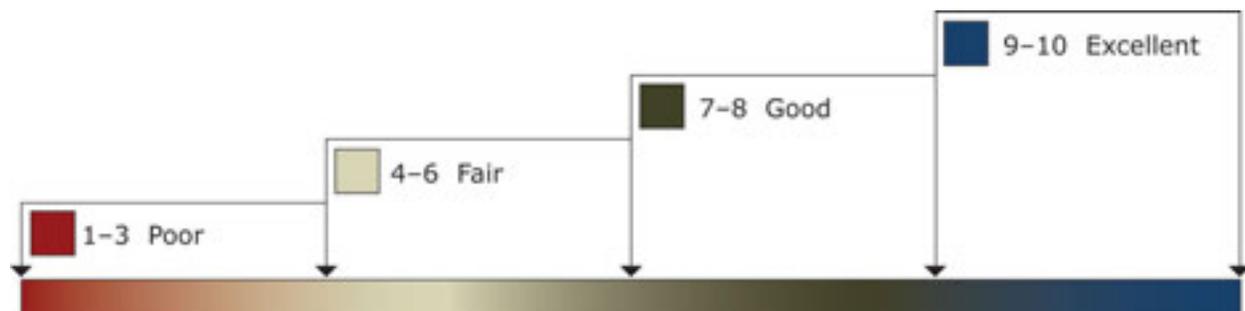
- Criterion 1: Price/Performance Value
- Criterion 2: Customer Purchase Experience
- Criterion 3: Customer Ownership Experience
- Criterion 4: Customer Service Experience
- Criterion 5: Brand Equity

Best Practice Award Analysis for PROXA

Decision Support Scorecard

To support its evaluation of best practices across multiple business performance categories, Frost & Sullivan employs a customised Decision Support Scorecard. This tool allows our research and consulting teams to objectively analyse 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 organised by Technology Leverage and Customer Impact (i.e., the overarching categories for all 10 benchmarking criteria; the definitions for each criteria 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 organisations reviewed, we have chosen to refer to the other key players as Competitor 2 and Competitor 3.

DECISION SUPPORT SCORECARD FOR ENABLING TECHNOLOGY LEADERSHIP AWARD

<i>Measurement of 1-10 (1 = poor; 10 = excellent)</i>			
Enabling Technology Leadership	Technology Leverage	Customer Impact	Average Rating
PROXA	9	9	9
Competitor 1	6	8	7
Competitor 2	5	5	5

Technology Leverage

Criterion 1: Commitment to Innovation

Requirement: Conscious, ongoing adoption of emerging technologies that enables new product development and enhances product performances

Criterion 2: Commitment to Creativity

Requirement: Technology is 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: Commercialisation 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 like 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

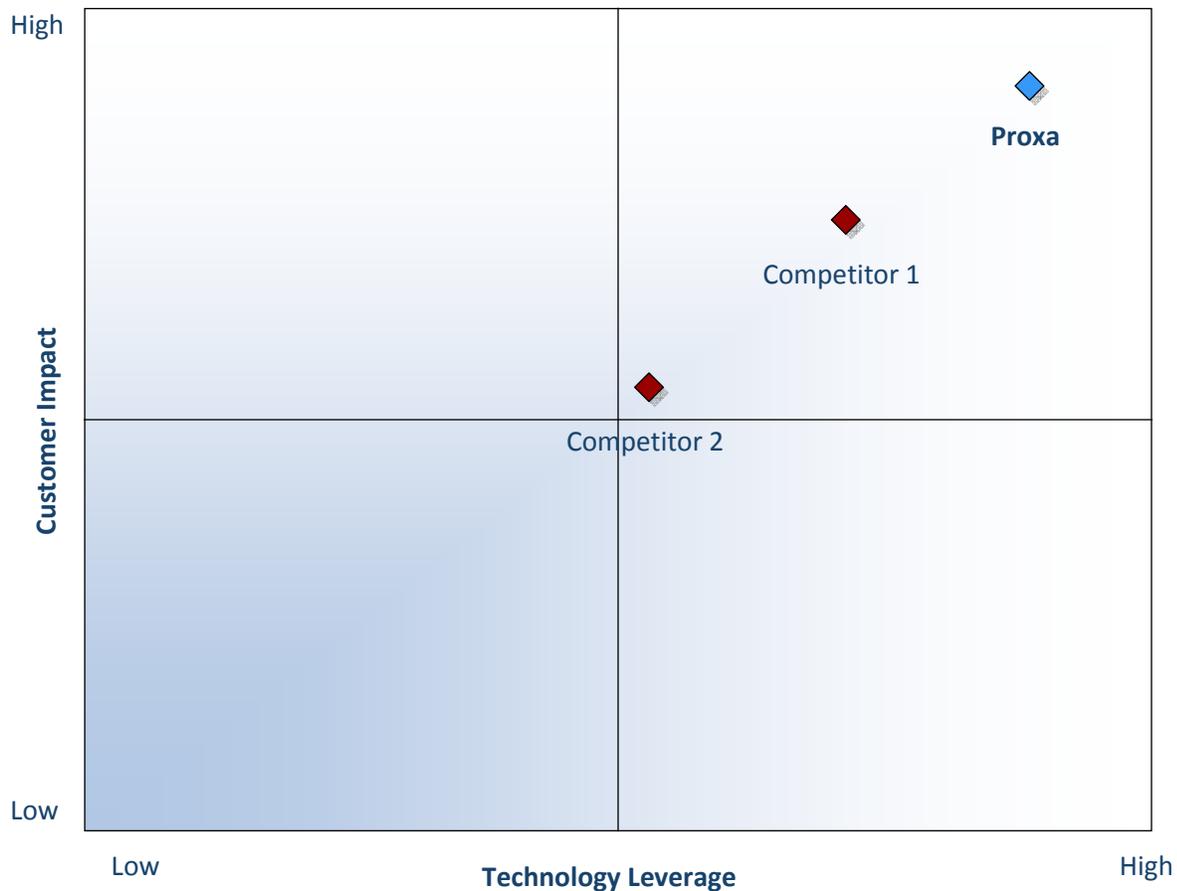
Criterion 5: Brand Equity

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 can 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.

DECISION SUPPORT MATRIX FOR ENABLING TECHNOLOGY LEADERSHIP AWARD



The Intersection between 360-Degree Research and Best Practices Awards

Research Methodology

Frost & Sullivan’s 360-degree research methodology represents the analytical rigour 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 players and for identifying those performing at best-in-class levels.

360-DEGREE RESEARCH: SEEING ORDER IN THE CHAOS



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

Frost & Sullivan Awards 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 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 winner	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 may 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

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 almost 50 years of experience in partnering with Global 1000 companies, emerging businesses and the investment community from 31 offices on six continents. To join our Growth Partnership, please visit <http://www.frost.com>.