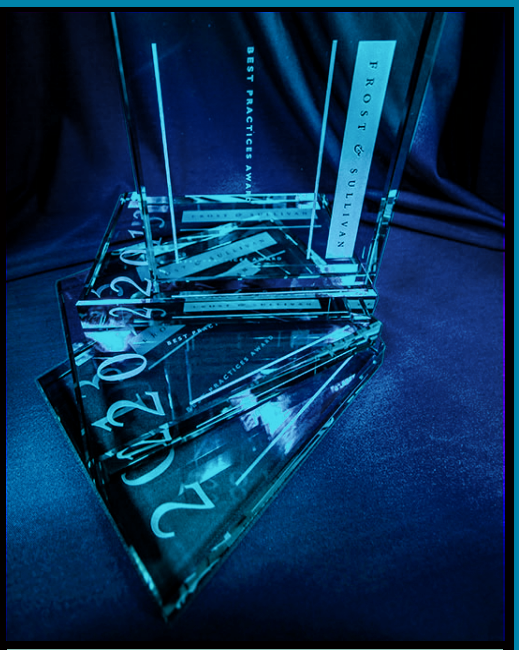
FROST & SULLIVAN

DNAnexus®

The Global Network for Genomics™

2016 Global Genomics Enabling Technology Leadership Award



FROST & SULLIVAN

2016 BEST PRACTICES AWARD

GLOBAL GENOMICS
ENABLING TECHNOLOGY LEADERSHIP AWARD

2016
BEST PRACTICES
AWARDS

Contents

Industry Challenges *3*

Technology Leverage and Customer Impact *3*

Conclusion 7

Understanding Enabling Technology Leadership 8

Key Benchmarking Criteria *9*

Best Practice Award Analysis for DNAnexus 9

Decision Support Scorecard *9*

Technology Leverage *10*

Customer Impact *10*

Decision Support Matrix *11*

Research Methodology *12*

Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices 13

About Frost & Sullivan 14

Background and Company Performance

Industry Challenges

The research community continually seeks newer technologies that solve unmet needs in their research workflows and enable ground-breaking breakthroughs. In order to move beyond the status quo, companies must solve unmet needs that cause research and technology limitations. These needs create opportunities for innovation and technology improvement for companies serving these laboratories.

Innovation, differentiation, and the ability to bring new capabilities to laboratory technologies are critical for successful life science companies. In order to deliver a market-changing technology, Frost & Sullivan points out that companies must markedly improve upon current state-of-the-art solutions, dramatically increase throughput and speed, improve ease-of-use, and maximize researchers' time. The ability to locate and solve unmet needs in the markets they serve and a commitment to resolving customers' workflow challenges are important features of the most successful companies in the life sciences tools market.

Technology Leverage and Customer Impact

Commitment to Innovation and Creativity

Frost & Sullivan proudly recognizes DNAnexus as the recipient of the 2016 Global Enabling Technology Leadership Award for the Genomics Industry. DNAnexus, based in Mountain View, CA, is the industry leader in cloud-based genome informatics and data management. Founded in 2009 as a spin-off from Stanford University, DNAnexus aimed to solve the emerging need for cloud computing and storage infrastructure for the rapidly expanding amount of next-generation sequencing data being generated by the global scientific community. With the rising adoption of next-generation sequencing by academic institutions, government collaborations, biopharmaceutical companies, and clinical laboratories, DNAnexus realized that the amount of data produced from the technology would rise exponentially in the coming years and require a more efficient way to store, share, analyze, and integrate data.

With that aim in mind, the company beta launched its current innovative and unique cloud-based DNAnexus Platform in 2013. The Platform allows users to rapidly and economically analyze the increasingly massive amounts of sequencing data being produced, integrate that data with existing phenotypic or clinical information, and share and collaborate with colleagues and peers around the world - all in a compliant, safe, and secure cloud environment. Ahead of its time in 2013, DNAnexus touted the benefits of a cloud-based computing and storage infrastructure and waited for government and industry to catch up and embrace the cloud as secure for genomics data. The company is now rapidly growing as next-generation sequencing technology has reached the right inflection point of speed, throughput, and cost to enable massive projects with the aim of sequencing tens or

hundreds of thousands of genomes. With this tremendous amount of data needing to be stored, computed, and analyzed, the genomics industry (from large genome centers to biopharmaceutical companies to clinical laboratories) are now embracing the cloud as a more efficient infrastructure for these tasks. As a result, many have turned to the DNAnexus Platform, and the company is experiencing rapid growth as it expands globally and across customer bases using sequencing. The US Government has also embraced the cloud via the adoption of the company's platform powering precisionFDA.

With its commitment to innovation and foresight into the future of sequencing technology, DNAnexus emerged with the enabling technology needed for scalable, secure, and collaborative genomics research in this new era of ultra-high throughput projects. For these reasons, DNAnexus is the most ideal recipient of the Frost & Sullivan Enabling Technology Leadership Award.

Customer Ownership Experience and Price/Performance Value

The DNAnexus Platform is a global infrastructure for managing and sharing genomic data safely and securely in the cloud. The Platform allows customers to easily and quickly upload data, control data access with collaborators, and perform analysis workflows with various integrated primary, secondary and tertiary analysis tools. At its core, the DNAnexus Platform is simple - yet it is packed with features and capabilities.

An end-user starts by uploading data to the cloud from anywhere in the world. DNAnexus provides multiple upload methods for ultimate flexibility, including command-line, upload via web platform, fetch from a URL, and direct upload via DNAnexus API. The Platform also includes an upload agent that enables multi-threaded data upload directly from the sequencing instrument, or at any point along the pipeline. The system automatically checks for data integrity during upload, ensuring data quality is intact. Furthermore, the Platform is sequencing technology agnostic, meaning it can upload from and integrate data from the various sequencing instrument providers.

Once uploaded, customers are assured their data are safe, secure, and compliant with privacy regulations. All data are encrypted, and tools and workflows are tracked and controlled to ensure quality. The Platform is ISO 27001 and 27002 compliant, and data compliant in accordance with HIPAA, CLIA, GCP, 21 CFR parts 11, 58, and 493, and European Data privacy laws and regulation for clinical applications. Furthermore, the Platform allows users to establish custom security policies, grant various access levels, and select multiple sign-in authentication methods depending on their needs.

For analysis capabilities, as an open platform the DNAnexus solution integrates with many upstream and downstream partners such as LIMS systems, instrument manufacturers, tertiary analysis, or clinical reporting and interpretation products. Users can even publish their own tools and analysis algorithms and share them with collaborators. As such, DNAnexus does not compete with the large array of bioinformatics tools available for next-generation sequencing data, but rather enables simple, fast, and scalable usage of these

tools as the infrastructure to do so.

The DNAnexus Platform also boasts tremendous price/performance value, allowing users to lower their compute and storage costs by always matching capacity to demand. This means that laboratories are never overpaying for unused capacity, nor are they stuck when it comes time to scale throughput. The Platform is infinitely elastic in its ability to scale and move data around the world. Furthermore, the Platform provides budget control capabilities through precise administrative access controls, resource usage management, and the ability to distribute costs along a partnership ecosystem.

Frost & Sullivan feels that the most practical, yet highly valuable feature of the DNAnexus Platform is the ability for networks of collaborators in the genomics community around the globe to share, transfer, access, integrate, and analyze genomic data easily within the cloud. With fine-tuned settings, the Platform can be tailored to the specific access requirements for each partner. With genomics projects finally scaled to the size of sequencing tens or hundreds of thousands of genomes, these initiatives often involve a global consortia of organizations working together. Ultimately, the DNAnexus Platform bridges those laboratories and the genomic data they are generating in a simple, intuitive, and feature-rich infrastructure.

Brand Equity

DNAnexus' rapid growth and the emergence of its Platform as a necessary infrastructure for next-generation sequencing data computing, storage, and sharing benefited from several seminal events that occurred during 2014–2015. First, the launch of Illumina's HiSeq X Ten sequencing system in 2014 brought about major throughput increases for sequencing, enabling exponentially larger datasets to be produced. Those datasets needed to be managed, stored, and analyzed, and many laboratories simply did not have the traditional onsite storage capacity and computing power for it. Many of those laboratories found the DNAnexus Platform to be absolutely critical for scaling their projects.

Secondly, in 2014, the National Human Genome Research Institute (NHGRI), the key institute responsible for genomics research at the National Institutes of Health (NIH), finally embraced the cloud for the ENCODE project. ENCODE, an acronym for the "Encyclopedia of DNA Elements", aims to identify all functional elements in the human genome sequence. Up to that point, the NHGRI had been reluctant to use and store NIH-generated genomic data in the cloud due to potential privacy and security issues. Completing a comprehensive security review, the agency confirmed that the DNAnexus Platform was safe, secure, and capable of securing a high-volume project such as ENCODE. Within a few months, NIH issued a security compliance program guidance letter, which in great detail laid out the requirements for researchers wishing to use NIH data in the cloud and listed additional security and compliance resources. DNAnexus was the only platform company whose security and compliance white paper was listed as an information resource for individuals seeking a working understanding of the NIH requirements.

Lastly, in 2015, DNAnexus was awarded a research and development contract to build a portal for the US Food and Drug Administration (FDA) - called precisionFDA. The portal interfaces with the genomics community, composed of NGS test providers, standards-making bodies, pharmaceutical and biotech companies, healthcare providers, academic medical centers, and research consortia, consumers or patients, and the FDA and other government agencies, where they can experiment, securely share data and tools, collaborate, and define standards for evaluating analytical pipelines and reference datasets. This contract award was yet another stamp of approval for the DNAnexus Platform and the security of cloud-based networks of genomic information.

All of these events contributed to further buy-in from the large community of next-generation sequencing users. Now biopharmaceutical companies are moving to the cloud for many of their activities, especially for genomics work. DNAnexus' Platform allows pharmaceutical companies to build a network for their sequencing data, enabling sharing and collaboration of sequencing data produced in one location and analysis performed at another of its locations. They can also integrate data generated from a number of CRO partners and their own laboratories in one place, enabling all of them to utilize the same bioinformatics tools and datasets simultaneously through the DNAnexus Platform. Thus, the DNAnexus Platform is becoming the global infrastructure for managing genomic data, and integrating genomic data with other data types.

To measure commercialization success beyond its relationship with the NIH and FDA, one need only to look at the wide array of partners that have attached themselves to the DNAnexus Platform to provide integrated solutions. These include Google, Qiagen, Intel, Pacific Biosciences, Tute Genomics, Sapio Sciences, BioNano Genomics, Omicia, WuXi NextCODE, and CareDx, among others. The company has also announced the usage of its platform by a tremendous lineup of top genome centers, global collaborations, and industry companies, such as the Broad Institute, Janssen, Qiagen, The Garvan Institute, Baylor College of Medicine, Natera, and Regeneron. With partners and customers across the entire spectrum of the genomics community, from government agencies to pharmaceutical companies, DNAnexus has positioned itself as the preeminent global leader for cloud-based genomic data management.

Conclusion

Frost & Sullivan firmly believes that the DNAnexus Platform is one of the most significant enabling technologies helping to usher in the era of large-scale genomics projects that are expected to expand beyond hundreds of thousands of genomes to sequencing millions of genomes. The technology helps sequencing laboratories and global project consortia overcome their infrastructure, scale, data storage, computing power, and geographic limitations. Serving as the global network for genomics, DNAnexus enables its customers to easily and securely store, analyze, and share genomic data. Ultimately, the company is facilitating the acceleration of discovery in genomics that can lead to new breakthroughs in healthcare. For its development of an industry-changing, innovative solution for the genomics community to better manage the exponentially increasing genomic data produced, Frost & Sullivan is pleased to present the 2016 Enabling Technology Leadership Award to DNAnexus.

Significance of Enabling Technology Leadership

Ultimately, growth in any organization depends upon 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—and making those customers happy is the cornerstone of any long-term successful growth strategy. To achieve these goals through 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, best-practice organizations deliver a unique and enjoyable experience that gives customers confidence in the company, its products, and its integrity.

Key Benchmarking Criteria

For the Global 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: Commercialization Success
Criterion 5: Application Diversity

Customer Impact

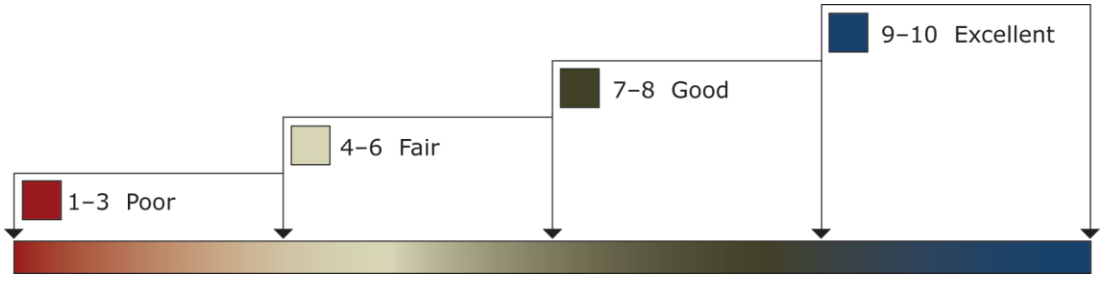
Criterion 1: Price/Performance Value
Criterion 2: Customer Purchase Experience
Criterion 3: Customer Ownership Experience
Criterion 4: Customer Service Experience
Criterion 5: Brand Equity

Best Practice Award Analysis for DNAnexus

Decision Support Scorecard

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

RATINGS GUIDELINES



The Decision Support Scorecard is organized by 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 organizations reviewed, we have chosen to refer to the other key players as Competitor 2 and Competitor 3.

Measurement of 1–10 (1 = poor; 10 = excellent)			
Enabling Technology Leadership	Technology Leverage	Customer Impact	**Average Rating**
DNAnexus	**9**	**10**	**9.5**
Competitor 2	6	5	5.5
Competitor 3	5	3	4.0

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: 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 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

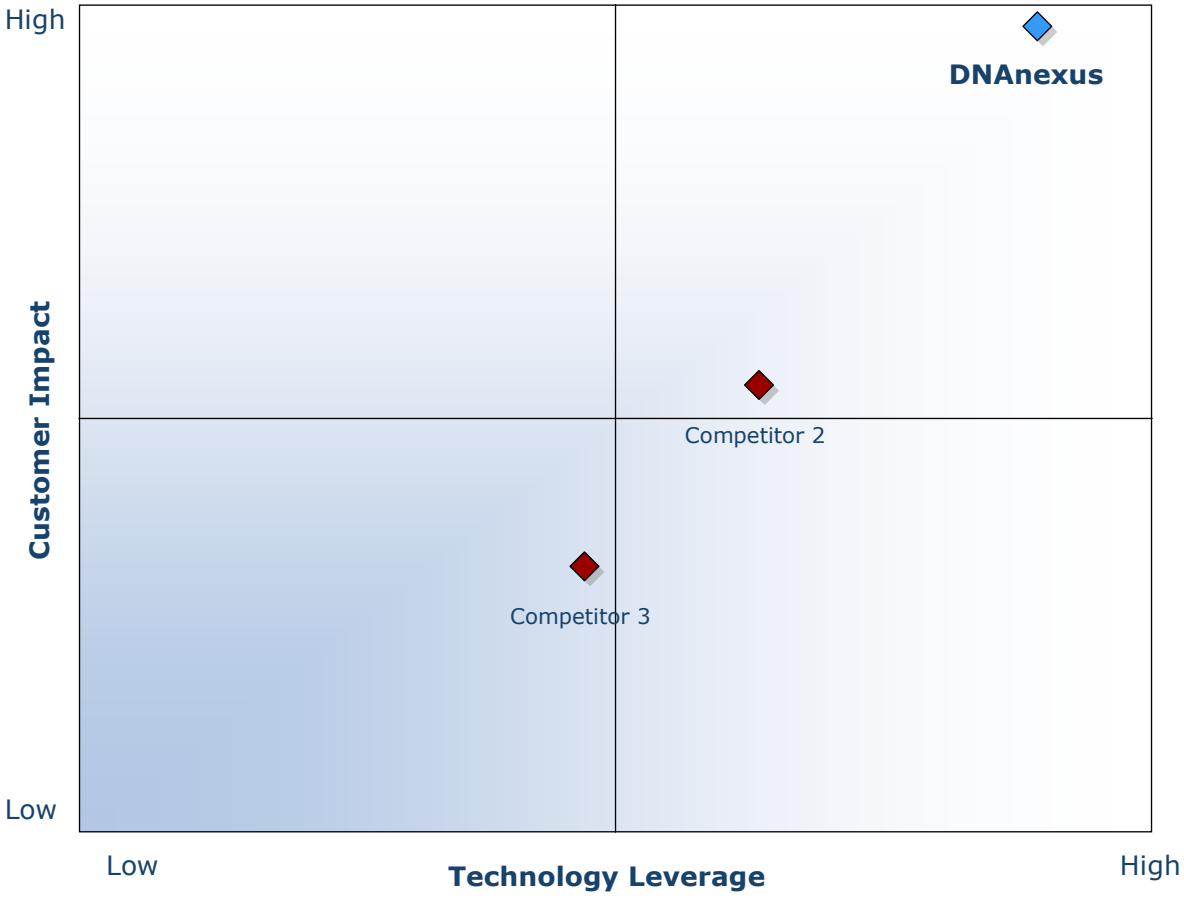
Criterion 5: Brand Equity

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 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 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 Recognizing 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.