FROST & SULLIVAN

2024

ENABLING TECHNOLOGY LEADER

IN THE NORTH AMERICAN AI-BASED SOLUTIONS FOR PRECISION ONCOLOGY INDUSTRY

FROST & SULLIVAN

BEST PRACTICES AWARD

2024

BostonGene

F R O S T & S U L L I V A N

Best Practices Criteria for World-Class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each award category before determining the final award recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. BostonGene excels in many of the criteria in the AI-based solutions for precision oncology.

BostonGene: Revolutionizing Approaches in Precision Oncology

In current clinical practice, most oncology care teams rely on targeted genomic panels, clinical manifestations, and histopathological methods, such as immunohistochemistry, for cancer treatment selection. Over the last decade, significant advancements in next-generation sequencing (NGS) technologies have made whole exome sequencing (WES) and RNA-seq a feasible and economical option for standard clinical practice. Translating integrated multi-omics platforms from bench to bedside can address the industry-wide challenges clinicians and pharmaceutical companies face in precision oncology.

BostonGene is a leading provider of AI-driven, molecular, and immune profiling focused on personalized cancer therapy. The organization provides multi-omics wet lab solutions and advanced analytics to support healthcare professionals in tailoring treatment to individual patients based on their unique genetic makeup, tumor, and tumor microenvironment (TME) characteristics, clinical attributes, and disease profiles.

> *"Frost & Sullivan identifies BostonGene as being at the forefront of oncological innovation, exemplified by its groundbreaking work in NGS, digital image analysis, and immunoprofiling platforms. With a commitment to precision and excellence, BostonGene's technologies and approaches underscore its dedication to advancing the field of oncology, offering comprehensive solutions that redefine the landscape of personalized cancer care."*
>
> *- Natalia Casanovas*
> *Best Practices Research Analyst*

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Pioneering Innovations in Biomarker-Driven Precision Oncology

BostonGene has a history of developing and implementing innovative technologies and tools for precision oncology. Offerings include:

- **RNA-seq Technology and Tools.** Beyond gene expression quantification, RNA–seq offers insights into malignant cell properties, immune cell infiltration, the tumor microenvironment, and gene fusions. BostonGene's RNA-seq expression bioinformatics pipeline was extensively validated, achieving approvals from stringent regulatory bodies, including the College of American Pathologists (CAP), Clinical Laboratory Improvement Amendments (CLIA), and New York State Department of Health (NYSDOH), with >90% accuracy. Using whole transcriptome RNA-seq, BostonGene is actively working to develop novel algorithms, protocols, and predictive models for biomarker discovery and analysis in oncology.

  BostonGene's Tumor Portrait™ test[1], integrating WES and RNA-seq, improves biomarker detection and clinical trial matching. An aggregated analysis of 1,000 BostonGene Tumor Portrait™ tests detected FDA-approved or NCCN-recommended biomarkers in 75.1% of patients, while 87.2% matched clinical trials. [2] By analyzing over 20,000 genes, BostonGene's RNA-seq pipeline can identify novel drug targets and clinically relevant biomarkers. The company's in-house algorithm, Kassandra™, accurately predicts cellular composition from bulk RNA-seq data to reconstruct the tumor microenvironment, empowering research and clinical applications.

- **Artificial Intelligence (AI) and Machine Learning (ML) Technology.** Computational technologies make analysis possible for big data (genomics, transcriptomics, and proteomics). BostonGene streamlines processes used for drug development and clinical decision-making. For its clinical pipeline, BostonGene developed essential tools (Hippocrates and digitized NCCN Guidelines®) to support customers' clinical decision-making. BostonGene's Hippocrates platform provides clinical decision support and NGS (Tumor Portrait™) result interpretation, while its in-house digitized NCCN Guidelines® module informs optimal treatment selection. BostonGene's robust team of computational biologists and bioinformaticians is actively engaged in ongoing efforts to improve extensive data analysis for biomarker discovery and new drug development. These innovations assess potential disease-relevant drug targets, driving new product development and elevating performance.

- **Digital image analysis.** These tools can be harnessed for objective image analysis, exemplified by ongoing work in automating digital pathology and multiplex immunofluorescence (MxIF) processes and analysis. BostonGene has projects focused on ML-based digital pathology utilizing techniques, such as convolutional neural networks, to identify clinically relevant biomarkers in oncology. Capable of analyzing over 40 markers on a single slide, MxIF facilitates the identification of potential biomarkers of response in cancer patients. BostonGene is actively collaborating with leading academic and pharmaceutical partners to assess mechanisms of therapeutic response, shedding light on the intricate cellular dynamics and their potential impact on treatment outcomes. BostonGene's

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[1] [BostonGene Tumor Portrait™ test - Bostongene](#), accessed December 2023.

[2] BostonGene's Interview with Frost & Sullivan, November 2023.

automated ML-based MxIF pipeline is capable of cell typing, cellular community analysis, cell-cell interactions, and protein expression quantification[3]. BostonGene is continuously expanding its portfolio of novel tools for automated image analysis in precision oncology.

- **Immunoprofiling.** Immunoprofiling is a powerful diagnostic tool for differentiating hematologic malignancies and predicting prognosis in oncology. BostonGene's immunoprofiling platform[4] pairs flow cytometry and peripheral blood mononuclear cell RNA-seq for oncology biomarker discovery and adverse event prediction that can expand to other diseases and conditions.

The company's robust bioinformatics, data annotation, continuous technological advancement, speed, and quality control ensures accurate and reliable test results. Still, BostonGene also bridges essential gaps in customer care by providing white glove service, a financial assistance program, and multidisciplinary team expertise. Overall, its dedication to innovation, efficiency, and customer support sets it apart as a leader in the field.

Frost & Sullivan identifies BostonGene as being at the forefront of oncological innovation, exemplified by its groundbreaking work in NGS, digital image analysis, and immunoprofiling platforms. With a commitment to precision and excellence, BostonGene's technologies and approaches underscore its dedication to advancing the field of oncology, offering comprehensive solutions that redefine the landscape of personalized cancer care.

Commitment to Excellence: Innovation, Collaboration, and Global Impact

BostonGene is dedicated to innovation and customer satisfaction, benefiting patients, healthcare providers, and biopharma partners with its advanced solutions, prioritizing user-friendly interfaces, actionable reports, and robust support services.

Engaging with patient advocacy groups and prestigious research institutions, the company tailors its approach to diverse client needs, demonstrating a blend of clinical and academic expertise. Markedly, the BostonGene-Integrated Genomic Registry study[5] (NCT04991922) invites patient participation in cancer research, aligning with its commitment to advancing diagnostics and uncovering actionable biomarkers.

The company emphasizes collaborations, publications, and success stories in marketing, contributing to a unique service experience. Notable features include state-of-the-art solutions, customizable approaches, and a patient financial assistance program.

Commitment, Collaboration, and Global Impact

A robust feedback mechanism involving advisory boards, meetings, negotiations, innovation, partnerships, and transparent communication ensures high standards and ongoing customer-focused precision oncology breakthroughs. BostonGene's journey through strategic alliances and agreements underscores its resolve to revolutionize cancer care.

- BostonGene was selected as a genomic partner for a clinical-stage biopharmaceutical company, supporting their first-in-human Phase I/II study of a TROP2-directed antibody-drug conjugate in

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[3] BostonGene Spatial Proteomics - Bostongene, accessed December 2023.
[4] BostonGene Immunoprofiling - Bostongene, accessed December 2023.
[5] Help BostonGene Beat Cancer - Bostongene, accessed December 2023.

patients with advanced cancers at leading cancer institutions across North America.

● In collaboration with a US-based community oncology research network, BostonGene announced the BEGIN study, a clinical trial designed to bring personalized medicine to community settings.

● BostonGene was awarded the GRASP Advocate Choice Award for recent advancements in the breast cancer space performed with Dr. Jason Mouabbi, assistant professor of Breast Medical Oncology at The University of Texas MD Anderson Cancer Center.

● Alliances with esteemed institutions, like MD Anderson Cancer Center, Sylvester Comprehensive Cancer Center at the University of Miami, Johns Hopkins School of Medicine, Memorial Sloan Kettering Cancer Center, Weill Cornell Medical College, and the National Cancer Institute (NCI), showcase BostonGene's commitment to exploring the tumor microenvironment and mutational landscapes, driving new insights and potential therapeutic avenues.

● Incorporating NCCN Guidelines® into the BostonGene Tumor Portrait™ test illustrates BostonGene's commitment to evidence-based care and fostering novel approaches in precision medicine.

● *Cancer Cell* recognized BostonGene's publication, "Conserved pan-cancer microenvironment subtypes predict response to immunotherapy,"[6] as one of ten research articles representing cutting-edge areas of cancer research and oncology for 2021.

BostonGene launched several initiatives to expand its global presence, forging strategic partnerships and collaborations worldwide.

● Partnerships with a prestigious academic hospital in Japan and an extensive research organization in Australia represent BostonGene's dedication to improving outcomes for cancer patients worldwide.

● BostonGene formed a joint venture (JV) in Japan with an IT industry leader and a private equity firm, aligning forces to streamline drug development and transform precision medicine for cancer patients. BostonGene's Japanese-based JV indicates the forthcoming adoption of the BostonGene Tumor Portrait™ test.

These developments signify a crucial step towards improving outcomes for cancer patients on a global scale.

Advancing Precision Medicine: Trailblazing Innovations and Pioneering Research

"Innovative, dedicated, and agile underscore the company's commitment to quality, transparency, and community engagement, reinforcing brand equity through ongoing innovation and value delivery."

- Natalia Casanovas
Best Practices Research Analyst

With a strong track record of strategic partnerships, conference presentations, and peer-reviewed publications, BostonGene's resolve to advance precision medicine is evident. In June 2023, the company launched a CLIA-certified and CAP-accredited Liquid Biopsy test. This cutting-edge portfolio expansion aims to accelerate the development of novel therapies and predictive

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[6] cell.com/cancer-cell/pdf/S1535-6108(21)00222-1.pdf, accessed December 2023.

models for precision medicine.

In October 2022, the company published a study shedding light on the heterogeneity in the TME of multiregional clear cell renal cell carcinoma (ccRCC).[7] This research yielded valuable insights into ccRCC treatment complexities, further solidifying BostonGene's leading position in oncology research. Publication of the "Precise reconstruction of the TME using bulk RNA-seq and a machine learning algorithm trained on artificial transcriptomes" in *Cancer Cell* showcased the groundbreaking cellular deconvolution algorithm, Kassandra™.

Using bulk RNA-seq, Kassandra precisely reconstructs the tumor microenvironment by identifying and quantifying over 50 cell types to provide critical information, such as PD-L1 expression and regulatory T cell content, to support clinical decision-making. In collaboration with Thomas Jefferson University, BostonGene also published research in *Clinical Cancer Research* on predicting immunotherapy responses for head and neck cancer patients.[8] These publications and collaborations further demonstrate BostonGene's dedication to exploring the intricacies of the tumor microenvironment and applying this knowledge to enhance precision treatment strategies.

Redefining Precision Oncology and Fostering Innovation in Healthcare

BostonGene strives to redefine standards of care in precision oncology by developing strategic collaborations and promoting continuous technological advancement. In the biopharma sector, BostonGene's multi-omics approaches and AI/ML-enabled tools are becoming industry standards for biomarker analysis, influencing patient stratification in drug development and accelerating innovation. These technologies are leading to a paradigm shift, fostering the next generation of diagnostic approaches in precision oncology.

At the core of BostonGene, creativity is vital to cultivating innovation. With a team of over 100 MDs and PhDs, the company assigns a dedicated R&D team to each research project, fostering a collaborative environment where team members are empowered to suggest ideas. BostonGene's successful approach to continuous innovation is evident in its substantial intellectual property portfolio and high-impact publications.

Over the next ten years, BostonGene will expand its technology to broader precision medicine applications, including diagnosing and treating complex diseases beyond cancer, such as autoimmune disorders. Customers can leverage BostonGene's solutions for biomarker identification, response prediction, and patient selection to facilitate drug development and improve clinical trial outcomes.

The company's efforts extend beyond product development. Collaborations with renowned institutions and validation through peer-reviewed research contribute to building brand visibility. Strategic partnerships with key opinion leaders at institutions like Memorial Sloan Kettering and Weill Cornell and contributions to industry conferences establish BostonGene as a thought leader in cancer care technologies.

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[7] Multiregional single-cell proteogenomic analysis of ccRCC reveals cytokine drivers of intratumor spatial heterogeneity: Cell Reports, accessed December 2023.
[8] Tadalafil Enhances Immune Signatures in Response to Neoadjuvant Nivolumab in Resectable Head and Neck Squamous Cell Carcinoma | Clinical Cancer Research | American Association for Cancer Research (aacrjournals.org), accessed December 2023.

Innovative, *dedicated*, and *agile* underscore the company's commitment to quality, transparency, and community engagement, reinforcing brand equity through ongoing innovation and value delivery.

Conclusion

BostonGene is at the forefront of revolutionizing precision oncology, driving the evolution of personalized cancer care with multi-omic technologies and an integrative bioinformatic pipeline. The company's commitment to advancing precision medicine is evident in its comprehensive suite of validated, cutting-edge transcriptomics, genomics, and proteomics solutions.

With an emphasis on customer satisfaction, BostonGene's client services department offers white glove service and a robust financial assistance program. In addition, the BostonGene-Integrated Genomic Registry was launched as an observational clinical trial (NCT04991922) to develop a collection of molecular and clinical data from 100,000 oncology patients for research use. These initiatives demonstrate BostonGene's commitment to providing white glove customer service and improving patient outcomes.

From pioneering first-in-human clinical trials to strategic partnerships addressing specific cancer types, BostonGene's multidisciplinary approach underscores its commitment to tailoring treatment strategies and elevating patient care. The company's trailblazing innovations in cancer care technologies position it as an industry leader.

BostonGene aims to reshape the precision medicine landscape by strategically focusing on novel research and delivering impactful solutions. The company envisions a future where personalized approaches are accessible for a spectrum of complex diseases, further solidifying its role in the future of precision medicine.

For its strong overall performance, Boston Gene earns Frost & Sullivan's 2024 North American Enabling Technology Leadership Award in AI-based solutions for precision oncology.

What You Need to Know about the Enabling Technology Leadership Recognition

Frost & Sullivan's Enabling Technology Leadership Award recognizes the company that applies its technology in new ways to improve existing products and services and elevate the customer experience.

Best Practices Award Analysis

For the Enabling Technology Leadership Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

Technology Leverage

Commitment to Innovation: Continuous emerging technology adoption and creation enables new product development and enhances product performance

Commitment to Creativity: Company leverages technology advancements to push the limits of form and function in the pursuit of white space innovation

Stage Gate Efficiency: Technology adoption enhances the stage gate process for launching new products and solutions

Commercialization Success: Company displays a proven track record of taking new technologies to market with a high success rate

Application Diversity: Company develops and/or integrates technology that serves multiple applications and multiple environments

Customer Impact

Price/Performance Value: Products or services provide the best value for the price compared to similar market offerings

Customer Purchase Experience: Quality of the purchase experience assures customers that they are buying the optimal solution for addressing their unique needs and constraints

Customer Ownership Experience: Customers proudly own the company's product or service and have a positive experience throughout the life of the product or service

Customer Service Experience: Customer service is accessible, fast, stress-free, and high quality

Brand Equity: Customers perceive the brand positively and exhibit high brand loyalty

About Frost & Sullivan

Frost & Sullivan is the Growth Pipeline Company™. We power our clients to a future shaped by growth. Our Growth Pipeline as a Service™ provides the CEO and the CEO's growth team with a continuous and rigorous platform of growth opportunities, ensuring long-term success. To achieve positive outcomes, our team leverages over 60 years of experience, coaching organizations of all types and sizes across 6 continents with our proven best practices. To power your Growth Pipeline future, visit Frost & Sullivan at http://www.frost.com.

The Growth Pipeline Engine™

Frost & Sullivan's proprietary model to systematically create ongoing growth opportunities and strategies for our clients is fueled by the Innovation Generator™.

Learn more.

Key Impacts:

■ **Growth Pipeline:** *Continuous Flow of Growth Opportunities*

■ **Growth Strategies:** *Proven Best Practices*

■ **Innovation Culture:** *Optimized Customer Experience*

■ **ROI & Margin:** *Implementation Excellence*

■ **Transformational Growth:** *Industry Leadership*

The Innovation Generator™

Our 6 analytical perspectives are crucial in capturing the broadest range of innovative growth opportunities, most of which occur at the points of these perspectives.

Analytical Perspectives:

■ **Mega Trend (MT)**

■ **Business Model (BM)**

■ **Technology (TE)**

□ **Industries (IN)**

□ **Customer (CU)**

■ **Geographies (GE)**