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FROST & SULLIVAN BEST PRACTICES AWARD

PRECISION IMAGING - GLOBAL

Visionary Innovation Leadership 2019

SIEMENS
Healthineers

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2019

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Contents

Background and Company Performance

Industry Challenges

Among the many transformative forces driving healthcare, one of the foremost in changing the approach to care delivery is precision medicine. Frost & Sullivan has identified precision medicine as one of the top ten themes in its analysis for Vision 2025: Future of Healthcare.

The National Institute of Health's Precision Medicine Initiative, the largest of its kind, defines the concept as, "an emerging approach for disease treatment and prevention that takes into account individual variability in genes, environment, and lifestyle for each person." The Initiative aims to generate the scientific evidence needed to move the concept from research to clinical practice by leveraging data from over 1 million volunteers in the United States who will share their genetic data, biological samples, diet and lifestyle information, and even their electronic medical records (optional).

Concurrent with other trends, the precision medicine concept is now expanding, even before becoming mature itself, to cover precision health. The precision health paradigm encompasses not just treatment of particular disease conditions, but the larger view of an entire population's health, a view to keep the masses healthier longer; ultimately, to end the trend of younger people falling prey to chronic, lifelong conditions.

Naturally, the precision medicine concept and the larger precision health concept have been driven by the life sciences realm of healthcare, with genetic information being leveraged to a great extent. In 1990, an international group embarked on what was considered an ambitious project, the Human Genome Project, an effort to sequence the entire human genome, which was completed in 2003. And 15 years or so after, in spite of having identified several DNA markers that correlate with disease, it has become clear that genomic information is only one piece of the puzzle needed to complete the full picture of personalized medicine, and even personalized health.

In particular, the role of medical imaging has been underestimated for its capability to deliver pieces of that puzzle. Medical imaging is crucial in diagnosis, and helps determine the correct course of treatment for some patients. The role it can play in precision medicine, therefore, is very real; however, a market player that fulfils this role for the entire imaging area is currently missing. The challenge facing the imaging community is to contribute solutions boldly to the precision paradigm, tools that can be translated to the clinical field and not left limited to academic research. To this end, a leader will need to demonstrate that imaging delivers added value, a viable proposition for providers both medically and economically. As such, the precision medicine concept will require providers to invest in high-end technology, so a medical imaging leader must demonstrate the monetary value achieved downstream of imaging, such as the benefit of getting therapy right the first time and allowing patients to recover faster, resulting in overall cost savings.

Focus on the Future and Best Practices Implementation

Siemens Healthineers, a leading medical imaging vendor, is taking a principal role in attempting to position medical imaging in the precision medicine landscape, essentially defining the concept of precision imaging itself. While competitors are making efforts in advancing the personalization concept, most do not appear to be considering the broader picture where imaging can be positioned prominently in the precision medicine landscape. For those competitors that seem to have made some efforts in this direction, their lack of a clear vision renders those efforts directionless on a company level, and therefore does not support their positioning as a market-defining strategist for precision imaging.

The Siemens Healthineers model starts with precision diagnosis, followed by individualized treatment and action. Siemens Healthineers' precision imaging efforts are spread across four pillars, all of which can be mapped to its product portfolio, denoting the commitment it demonstrates to leadership in this emerging landscape.

Pillar 1: Improved Diagnostic Accuracy

Siemens Healthineers is leveraging several advances in imaging equipment, imaging IT, and informatics to provide higher image quality to extract more solid insights from imaging studies across modalities.

For instance, Siemens Healthineers is planning to enable new levels of comparability and consistency in MRI studies through MR fingerprinting*, which is an approach designed for quantitative data acquisition. Using the multiparametric maps acquired simultaneously quantitative information may provide prognostic information by supporting physicians detect tissue changes earlier.*

Another example is the PET-CT quantification capability, which is very precise as well when imaging a tumor for determining its size, location, and volume. The higher resolution of the image adds value for the radiologist in making the diagnosis and deciding the next course of action.

Siemens Healthineers is also enabling personalized ultrasounds by developing clinical applications for real-time assessment adapted to a variety of clinical conditions: liver for chronic liver disease; breast for breast disease; and muscles, nerves, ligaments, and tendons for musculoskeletal disorders. It also leverages artificial intelligence (AI) as an enabler for advanced applications.

Frost & Sullivan notes that although the competition is taking efforts on similar lines, the end-goal of enabling better, personalized insights for improving patient outcomes within

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* MR Fingerprinting is currently under development; is not for sale in the U.S. Its future availability cannot be guaranteed.

the precision medicine paradigm is not as well-defined among them as it is for Siemens Healthineers, therefore making this one of the strong pillars necessary to support the precision imaging approach of the future.

Pillar 2: Concordance Always

Medical imaging is beset with unwarranted variations, making it difficult to compare two different studies of the same patient (longitudinal view) or even of different patients for comparative analyses. In the absence of variability, any deviations or changes can be attributed to the specificity of the patient, and not to other factors such as use of a different imaging facility, scanner, or operator. Any standardization to reduce this variability can become the key to interpret differences between cohorts of patients, allowing better understanding of disease progression and characteristics thus advancing the precision medicine concept.

Siemens Healthineers has developed the BioMatrix Technology on its MRI platforms, featuring Respiratory, and Kinetic sensors; these are devices with motion detection or correction capabilities which capture when a patient moves and incorporates this information into the image acquisition process to provide precise imaging results. Also, the FAST 3D-camera tracks patient position and motion to ensure image quality, and to standardize and adjust image acquisition protocols.

Frost & Sullivan acknowledges Siemens Healthineers as one of the pioneers in using early generation machine learning algorithms, and a company that continues to advance its AI applications in radiology to address issues such as variability, even when the medical imaging has only recognized the potential of AI in the last few years. The company's advanced variability-reducing efforts therefore enable it to position this as a strong pillar for enabling precision imaging.

Pillar 3: Personalized When It Matters Most

So far, precision medicine concepts have relied on genomics for profiling patients or selecting drug treatments, but there are other 'omics' fields that can provide additional insights to make care more personalized. For example, in radiomics and phenomics medical images can be leveraged to find clues, signatures, or features that help identify specific biomarkers to individual patients' disease conditions. Then, similar to genomics, these can help categorize patients into cohorts and decide the best course of treatment based on their disease features.

To enable these approaches, patient datasets from not just imaging but other sources, such as medical records, need to be aggregated and integrated in ways that make most sense, bringing together disparate data sources such as genomic data, doctors' notes in medical records, and even wearables' data, for example. Siemens Healthineers is addressing this challenge through its digital services, in some ways working to become the IT ecosystem enabler needed to establish the precision imaging value proposition.

The competition may have comparable solutions available, but Frost & Sullivan appreciates Siemens Healthineers' efforts to break down internal and customer silos as a way to integrate data in a patient-centric manner that affects personalized treatment approaches.

Pillar 4: Advanced Therapy Outcomes

Apart from the existing initiatives towards personalizing the diagnostic aspects and helping decide on care pathways, the logical next step is the execution of the therapies using imaging in a precise manner. In terms of image-guided therapies including interventional neuroradiology and interventional oncology, hybrid operating rooms, or minimally-invasive surgeries that depend on imaging, all can be made more precise or personalized in some ways.

Siemens Healthineers' ARTIS pheno that is designed to be patient-oriented for angiography procedures is one such solution. Addressing challenges restraining existing systems, the Siemens Healthineers' system has a wide-space C-arm, a flexible isocenter, and faster 3D imaging times that allow for reduced contrast media usage.

Frost & Sullivan applauds Siemens Healthineers for building up this pillar in addition to the others to provide holistic solutions in precision imaging, instead of focusing only on those where its greatest strength lies.

Open View to Building the Ecosystem

It is clear that no single vendor can deliver all the pieces necessary for enabling the precision imaging paradigm. Therefore, it is important to have an open view towards constructive partnerships to complete the vision. Siemens Healthineers demonstrates this critical quality by partnering with other vendors that supply pieces it does not have comparable capabilities in. This too is done in a fashion that attracts the best and brightest partners in delivering a value proposition. For example, Siemens Healthineers has introduced *syngo*.via OpenApps and opened its platform for 3rd party applications. Amongst others Siemens Healthineers has partnered with Materialise NV to make the Mimics inPrint software available to radiologists in hospitals. The partnership allows radiologists to work with surgical teams by helping 3D print personalized anatomical models, especially for complex anatomical pathologies for surgical planning, patient communication, or even training. Partner applications can be downloaded and integrated within *syngo*.via using the Siemens Healthineers Digital Marketplace

When embarking upon uncharted territory in the healthcare industry, joining forces with other top players is considered by Frost & Sullivan as an industry best practice because it complements the strengths of each player, multiplying their effect and ensuring success. Siemens Healthineers exemplifies this practice in its partnership with companies like Materialise, which is a leader in the 3D printing industry.

Conclusion

Of all the major original equipment manufacturers, Siemens Healthineers is clearly leading the charge in establishing imaging as an active contributor to precision medicine. It is taking a holistic view of its wide portfolio, and pulling all capabilities together to enable this effort, from diagnosis to therapy; the personnel in charge of leading this effort have a cross portfolio view of how all the verticals can contribute to this paradigm.

For its strong overall performance, Siemens Healthineers has earned Frost & Sullivan's 2019 Visionary Innovation Leadership Award.

Significance of Visionary Innovation Leadership

A Visionary Innovation Leadership position enables a market participant to deliver highly competitive products and solutions that transform the way individuals and businesses perform their daily activities. Such products and solutions set new, long-lasting trends in how technologies are deployed and consumed by businesses and end users. Most important, they deliver unique and differentiated benefits that can greatly improve business performance as well as individuals' work and personal lives. These improvements are measured by customer demand, brand strength, and competitive positioning.

Understanding Visionary Innovation Leadership

Visionary Innovation is the ability to innovate today in the light of perceived changes and opportunities that will arise from Mega Trends in the future. It is the ability to scout and detect unmet (and as yet undefined) needs and proactively address them with disruptive solutions that cater to new and unique customers, lifestyles, technologies, and markets. At the heart of visionary innovation is a deep understanding of the implications and global

ramifications of Mega Trends, leading to correct identification and ultimate capture of niche and white-space market opportunities in the future.

Key Benchmarking Criteria

For the Visionary Innovation Leadership Award, Frost & Sullivan analysts independently evaluated two key factors—Focus on the Future and Best Practices Implementation—according to the criteria identified below.

Focus on the Future

Criterion 1: Focus on Unmet Needs
Criterion 2: Visionary Scenarios through Mega Trends
Criterion 3: Growth Pipeline
Criterion 4: Blue Ocean Strategy
Criterion 5: Growth Performance

Best Practices Implementation

Criterion 1: Vision Alignment
Criterion 2: Process Design
Criterion 3: Operational Efficiency
Criterion 4: Technological Sophistication
Criterion 5: Company Culture

Best Practice Award Analysis for Siemens Healthineers

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
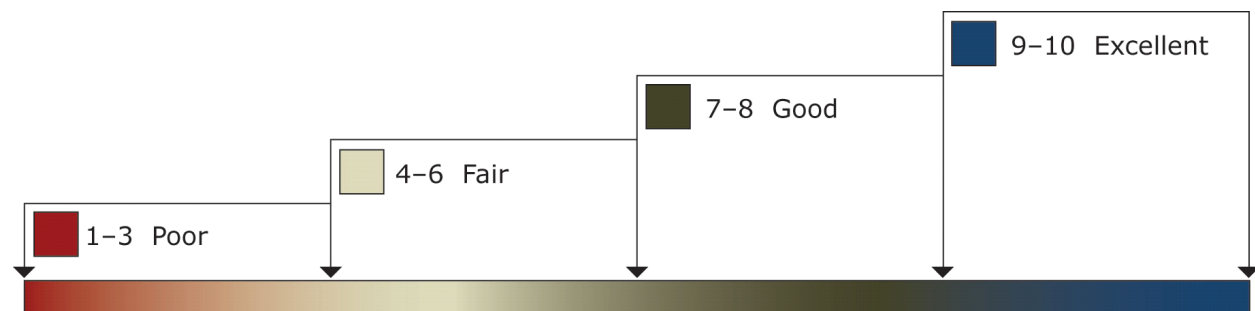
The Decision Support Scorecard is organized by Focus on the Future and Best Practices Implementation (i.e., these are the overarching categories for all 10 benchmarking criteria; the definitions for each criterion are provided beneath the scorecard.). The

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)			
Visionary Innovation Leadership	Focus on the Future	Best Practices Implementation	**Average Rating**
Siemens Healthineers	**10**	**8**	**9**
Competitor 2	9	7	8
Competitor 3	7	6	6.5

Focus on the Future

Criterion 1: Focus on Unmet Needs
Requirement: Implementing a robust process to continuously unearth customers' unmet or under-served needs, and creating the products or solutions to address them effectively

Criterion 2: Visionary Scenarios through Mega Trends
Requirement: Incorporating long-range, macro-level scenarios into the innovation strategy, thereby enabling "first-to-market" growth opportunity solutions

Criterion 3: Growth Pipeline
Requirement: Best-in-class process to continuously identify and prioritize future growth opportunities leveraging both internal and external sources

Criterion 4: Blue Ocean Strategy
Requirement: Strategic focus on creating a leadership position in a potentially "uncontested" market space, manifested by stiff barriers to entry for competitors

Criterion 5: Growth Performance
Requirement: Growth success linked tangibly to new growth opportunities identified though visionary innovation

Best Practices Implementation

Criterion 1: Vision Alignment
Requirement: The executive team is aligned along the organization's mission, vision, strategy, and execution.

Criterion 2: Process Design
Requirement: Processes support the efficient and consistent implementation of tactics designed to implement the strategy.

Criterion 3: Operational Efficiency

Requirement: Staff performs assigned tactics seamlessly, quickly, and to a high-quality standard.

### Criterion 4: Technological Sophistication

Requirements: Systems enable companywide transparency, communication, and efficiency.

Criterion 5: Company Culture

Requirement: The executive team sets the standard for commitment to customers, quality, and staff, which translates directly into front-line performance excellence.

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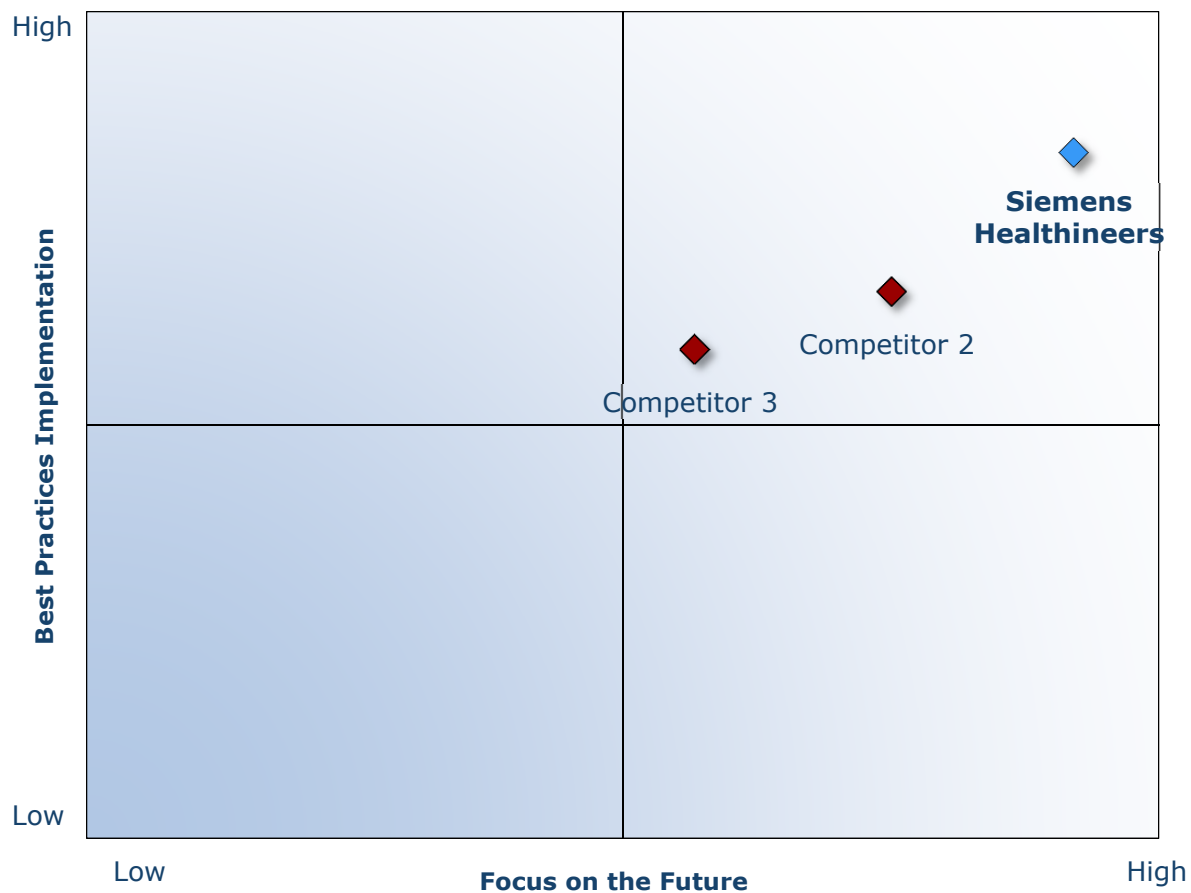
Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices

Frost & Sullivan 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 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 players 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.