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PROSCIA®

2017 Global Cloud-Based Digital Pathology Enabling Technology Leadership Award

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2017 BEST PRACTICES AWARD

GLOBAL CLOUD-BASED DIGITAL PATHOLOGY ENABLING TECHNOLOGY LEADERSHIP AWARD

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Importance of Digitizing Pathology Workflows

Pathology laboratories have been transitioning to digital workflows over the past 8 to 10 years. However, it is important to note that digitization and automation has penetrated through only certain parts of the entire pathology workflow leaving ample scope for deploying a complete, fully digitized, end to end automated workflow. The uptake of a fully automated digitized workflow has been restricted to a handful of top pathology departments globally. A complete digital pathology workflow can be defined as a pathologists's cockpit powered with the ability to assimilate all the disparate sources of information at his/her finger tips.

As the traditional pathology workflow gradually moves towards modernization, labs will see adoption of faster imaging and next generation analytical tools designed to support digital processes. Many laboratories are adopting a digital workflow to compensate for the shortage of experienced pathologists and a rise in the number of cancer cases. In fact, research and medical laboratories have been the first to make the transition, and hence digital pathology workflows using various components of an automated solution are gaining rapid adoption within this sector. Further, the FDA's clearance of Philips' platform for primary diagnosis has opened up a huge extension into the clinical space, meaning wider exposure for this technology.

Transitioning from a manual to a digitized workflow involves many considerations, such as scalability, compliance, and cost efficiency. Currently, the traditional workflow involves pathologists physically viewing biopsy slides and evaluating the sample under the microscope. It is worth noting that digital pathology is still in a very early stage compared to other fields such as radiology that transitioned to a digitized workflow 15 to 20 years ago. The newer workflow models are aimed at offering support systems to pathologists, including digitizing images, running analysis on those images, and providing feedback to pathologist with more information than what they can perceive with the naked eye. Overall, digitization has demonstrated improved operational efficiency and promises to dramatically enhance the practice of pathology.

Challenge: Software Market Has Yet to Catch Up

As many whole slide image scanner market have emerged vying for the expected pathology transition to digital, the focus on development and innovation has shifted towards software, particularly to image analysis and data management. Although many hospitals have transitioned to scanners as an essential first step in the adoption of digital pathology and digitized workflows, the IT infrastructure required to support digitization is tremendously underdeveloped.

Much of the unmet need today is in the area of software platforms from both a data management and storage perspective in handling large image sizes as well as image analysis algorithms as a way to gain consensus among the clinical community on the

viability of automated diagnosis. These challenges remain constant across all workflows within clinical, academic, and pharma research.

Challenge: Capital Expense Burden

Many pathology laboratories grapple with capital expenses, with the bulk of investment spent on purchasing scanners ($100,000 to $150,000), follow up/add-on expenses for companion software, consultations and support, IT personnel, and maintenance, as well as other factors that further burden operating expenses. The financial pressure has cascaded to an extent where pathology labs have become vulnerable to acquisitions with not much profit to spare under the falling reimbursement scenario and payment cuts experienced for for the pathology tests.

What Is the Solution?

Cloud-based digital pathology offers a triple benefit: improved quality of care for patients, increased efficiency for the clinician, and decreased upfront expenses for the hospital/lab. Switching to cloud also eliminates expenses associated with capital investment, installation, and updating costs. Cloud-based delivery of solutions has also proven to decrease burden on IT staff, reduce installation time, and eliminate the need for costly IT infrastructure. These benefits can truly globalize digital pathology and promote telepathology to a large extent for a field in which sharing and communication is key. Nevertheless, cloud is only a means to deliver the product; the solution must scale, supply a growing set of functionalities, operate with a central cloud infrastructure, and, most importantly, provide a HIPAA compliant and securely accessible environment.

Technology Leverage and Customer Impact

### Commitment to Innovation and Creativity

Proscia is a data and analytics solutions provider for digital pathology aiming to improve clinical outcomes and accelerate the discovery of breakthrough advancements in the fight against cancer. Using modern computing technologies that unlock hidden data not visible to the human eye and turning that data into valuable insights in the fight against cancer, the company is dedicated to improving the efficiency, speed and quality of pathology diagnostics and research. Frost & Sullivan recognizes Proscia as a futuristic, disruptive, and game-changing company to watch in this industry.

Proscia's cloud platform offering, Pathology Cloud, employs key technologies to access, analyze, and share whole slide images with unprecedented speed, accuracy, and quality. With these abilities, the company provides a unified solution for data management, telepathology, and image analysis. Frost & Sullivan applauds Proscia for achieving the first cloud-based solution provider status focused on driving down the cost of storage and image analysis in the field of pathology. The company is helping convert capital expense to operational expense. With Proscia's solution, customers don't invest in hardware or set-up costs for image storage.

Proscia's plug-and-play model enables its software platform for data management, telepathology, and image analysis to provide a wide range of functionalities to address the specific use-cases of its customers. Its openness also enables Pathology Cloud to communicate with any scanner in the market. In other words, this cutting-edge solution is scanner-agnostic. It supports all leading WSI formats and static images from whole slide scanner vendors such as Leica (Aperio), Philips Digital Pathology, Roche (Ventana), 3D Histech, and Huron Digital Pathology, which is one of the key distinguishing aspects of the Pathology Cloud platform.

A simple calculation aids in understanding how Proscia eliminates unwanted costs for a pathology lab. Assuming that the cost of storage servers is calculated based on $4 per image with 178,000 image capacity, storage costs account for about 71% of the capital expense. Transitioning to a cloud-based digital pathology solution can reduce IT personnel (2%) and implementation costs (7%), and completely eliminates capital expenses associated with storage servers (71%) and processors (15%). These cuts reduce costs significantly.

Digital Pathology Market: Cost Break Down, US, 2017
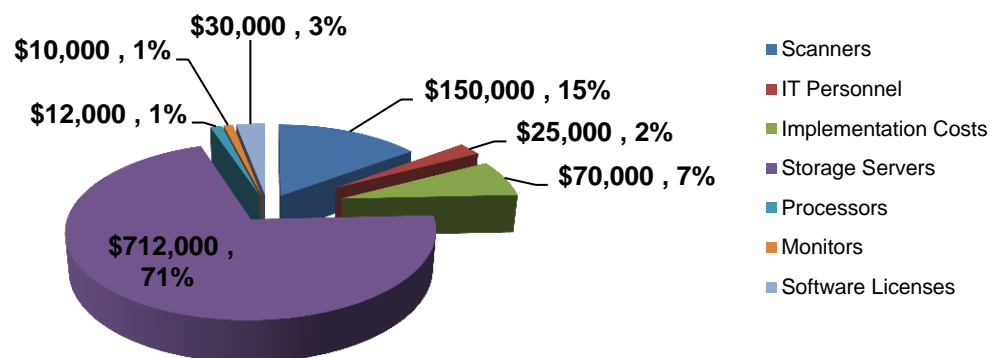
Although customizable according to the facility type, Proscia offers substantially lower-priced packages to access its storage, telepathology, and image analysis suites in comparison to its competitors. Starting with a free trial, for individuals, the packages are priced at $1,000 per year. Proscia offers enterprise packages that include its data management, telepathology, and image analysis suites to entire institutions.

Stage Gate Efficiency

Pathology in the cloud is the next giant leap in the area of digital pathology, and Frost & Sullivan analysis reveals that Proscia is rightly positioned to improvise whole slide image workflows by tapping into this trend. The company's use of Amazon Web Services (AWS) enables clinicians and researchers to access data securely whenever necessary and from anywhere across the world. However, pathology images are quite large in size, so data transfers can pose a serious challenge. Proscia's pathology cloud offering meets this

challenge. It is structured to diverse needs in this space and offers a set of 3 hybrid means to move data into cloud (i.e., low volume (<1 TB/day), high volume (1-25TB/day), extremely high volume (>25TB/day)). Further, this scanner-agnostic Pathology Cloud solution can handle virtually all WSI and static image formats. Given its built-in integration with Box and Dropbox, the data can be seamlessly migrated from cloud providers such as AWS, Microsoft Azure, or Google onto Proscia's platform in just minutes if the user is already leveraging cloud for its digital pathology. The company's products are designed to provide multi-gigabyte digital pathology cloud-based storage and to leverage its second-opinion collaboration technology. Currently, Proscia offers up to 50 GB storage space for its trial users.

With collaboration positioned as a cornerstone of Proscia's platform, pathologists can seamlessly and instantly access second-opinion consults on a case with specialists anywhere in the world. Pathology Cloud enables pathologists to manage their own private secure slide repositories, share, and collaborate in real time with a team or global network of expert pathologists, with access to thousands of slides and associated case data from The Cancer Genome Atlas (TCGA) Research Network and other similar institutions. Its research use only (RUO) image analysis suite provides instantaneous access to quantification of common IHC stained slides.

Proscia has earned Frost & Sullivan's recognition for its strategic thought leadership, innovation and performance exhibited in the cloud pathology space. By focusing on both the process and the product, this innovative company is able to clearly adhere to the Stage Gate model and enter the market as fast as possible by eliminating unnecessary steps. The company follows three different sales channels to establish its commercialization strategy: a) partnership and other alliances, b) direct sales, and c) OEM.

Application Diversity

From an application standpoint, Proscia is laser-focused on catering to the clinical world beyond pharma and academia. This strategy represents a massive opportunity for medical application given the recent FDA clearance for Philip's platform. Its built-in tissue quantification modules are quicker and easier to deploy along with data management and telepathology capabilities. As of today, there are over 800 users of Proscia's cloud-based technology for digital pathology with a considerable number of slides under management across 40 countries. Key applications of its image analysis modules are stain-specific quantification; biomarker-agnostic analysis, which aids in new biomarker development; and a ground truth creation modules, which leverages all three core suites of the product to conduct large, inter-institutional studies rapidly. The three categories are part of Proscia's powerful machine learning and computing environment, which is driving the development of breakthrough advancements in the fight against cancer. These applications are apt to different customers groups such as academic medical centers, diagnostic laboratories, and biopharmaceutical companies.

The company has released nine image analysis modules targeted at prostate, breast, and skin cancer for research use only (RUO). Currently, algorithms are available for biomarker analysis of HER2, EGFR, ER/PR, Ki-67, PD-L1 and H&E nuclear quantification, IHC nuclear

quantification, and IHC Cell membrane quantification. Prostate and breast cancer represent the leading causes of cancer death within and outside of the United States, while dermatopathology (skin) forms the bulk of samples analyzed in the pathology lab today. By targeting markets for cancers presenting with the highest incidence, Proscia is positioned to make a large impact in the understanding, diagnosis, and treatment of disease.

This disruptive firm is focused on partnering and collaborating with leading cancer research institutes across the world to train AI-based algorithms to tackle some of the toughest challenges in cancer diagnosis and care. These algorithms are being trained to predict metastases in breast cancer patients, a process that can be expanded to other cancer types. These predictive and prognostic algorithms address challenges left unanswered by the molecular biomarkers and genomic tests that are used today and shift the paradigm of diagnostic medicine.

Data from diagnostic instruments, analyzers have no value if there are no appropriate tools to analyze and interpret the data. Proscia is also actively venturing partnerships outside of digital pathology spectrum such as next generation sequencing to develop predictive AI-algorithms that can aid molecular pathologists with faster diagnosis and advance cancer care.

Conclusion

Proscia is focused on ushering computational pathology into laboratories. With the objective of advancing cancer care and treatment, Proscia brings together machine learning, computer vision, and cloud computing to revolutionize how histological patterns are read on whole slide images. Its solutions can quantify tissue in ways not possible from using a microscope or the naked eye. By facilitating data management, telepathology, and image analysis via cloud, this far-sighted company is well positioned to build strategic thought leadership in the future of digital pathology.

With its strong overall performance, Proscia has earned Frost & Sullivan's 2017 Enabling Technology Leadership Award.

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 enabling technology leadership, an organization must be best-in-class in three key areas: understanding demand, nurturing the brand, and differentiating from the competition.

- Acquire competitors' customers
- Increase renewal rates
- Increase upsell rates
- Build a reputation for value
- Increase market penetration

- Earn customer loyalty
- Foster strong corporate identity
- Improve brand recall
- Inspire customers
- Build a reputation for creativity

DEMAND

BRAND

Enabling Technology Leadership

COMPETITIVE POSITIONING

- Stake out a unique market position
- Promise superior value to customers
- Implement strategy successfully
- Deliver on the promised value proposition
- Balance price and value

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 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 Practices Award Analysis for Proscia

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
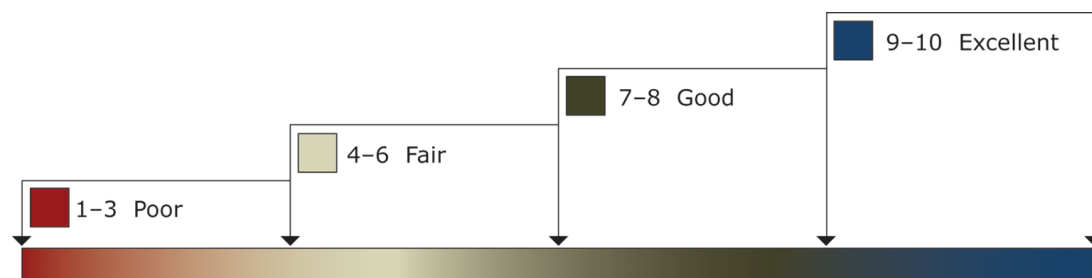
The Decision Support Scorecard is organized by Technology Leverage and Customer Impact (i.e., these are the overarching categories for all 10 benchmarking criteria; the definitions for each criterion are provided beneath the scorecard.). The research team confirms the veracity of this weighted scorecard through sensitivity analysis, which confirms that small changes to the ratings for a specific criterion do not lead to a significant change in the overall relative rankings of the companies.

The results of this analysis are shown below. To remain unbiased and to protect the interests of all organizations reviewed, we have chosen to refer to the other key participants as Competitor 2 and Competitor 3.

Measurement of 1–10 (1 = poor; 10 = excellent)			
Enabling Technology Leadership	Technology Leverage	Customer Impact	**Average Rating**
Proscia	**9.0**	**10.0**	**9.5**
Competitor 2	8.0	8.0	8.0
Competitor 3	7.0	8.0	7.5

Technology Leverage

Criterion 1: Commitment to Innovation

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

Criterion 2: Commitment to Creativity

Requirement: Technology 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 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.

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

Frost & Sullivan analysts follow a 10-step process to evaluate Award candidates and assess their fit with select best practice criteria. The reputation and integrity of the Awards are based on close adherence to this process.

STEP		OBJECTIVE	KEY ACTIVITIES	OUTPUT
1	**Monitor, target, and screen**	Identify Award recipient candidates from around the globe	• Conduct in-depth industry research • Identify emerging sectors • Scan multiple geographies	Pipeline of candidates who potentially meet all best-practice criteria
2	**Perform 360-degree research**	Perform comprehensive, 360-degree research on all candidates in the pipeline	• Interview thought leaders and industry practitioners • Assess candidates' fit with best-practice criteria • Rank all candidates	Matrix positioning of all candidates' performance relative to one another
3	**Invite thought leadership in best practices**	Perform in-depth examination of all candidates	• Confirm best-practice criteria • Examine eligibility of all candidates • Identify any information gaps	Detailed profiles of all ranked candidates
4	**Initiate research director review**	Conduct an unbiased evaluation of all candidate profiles	• Brainstorm ranking options • Invite multiple perspectives on candidates' performance • Update candidate profiles	Final prioritization of all eligible candidates and companion best-practice positioning paper
5	**Assemble panel of industry experts**	Present findings to an expert panel of industry thought leaders	• Share findings • Strengthen cases for candidate eligibility • Prioritize candidates	Refined list of prioritized Award candidates
6	**Conduct global industry review**	Build consensus on Award candidates' eligibility	• Hold global team meeting to review all candidates • Pressure-test fit with criteria • Confirm inclusion of all eligible candidates	Final list of eligible Award candidates, representing success stories worldwide
7	**Perform quality check**	Develop official Award consideration materials	• Perform final performance benchmarking activities • Write nominations • Perform quality review	High-quality, accurate, and creative presentation of nominees' successes
8	**Reconnect with panel of industry experts**	Finalize the selection of the best-practice Award recipient	• Review analysis with panel • Build consensus • Select recipient	Decision on which company performs best against all best-practice criteria
9	**Communicate recognition**	Inform Award recipient of Award recognition	• Present Award to the CEO • Inspire the organization for continued success • Celebrate the recipient's performance	Announcement of Award and plan for how recipient can use the Award to enhance the brand
10	**Take strategic action**	Upon licensing, company is able to share Award news with stakeholders and customers	• Coordinate media outreach • Design a marketing plan • Assess Award's role in future strategic planning	Widespread awareness of recipient's Award status among investors, media personnel, and employees

The Intersection between 360-Degree Research and Best Practices Awards

Research Methodology

Frost & Sullivan's 360-degree research methodology represents the analytical rigor of our research process. It offers a 360-degree-view of industry challenges, trends, and issues by integrating all 7 of Frost & Sullivan's research methodologies. Too often companies make important growth decisions based on a narrow understanding of their environment, leading to errors of both omission and commission. Successful growth strategies are founded on a thorough understanding of market, technical, economic, financial, customer, best practices, and demographic analyses. The integration of these research disciplines into the 360-degree research methodology provides an evaluation platform for benchmarking industry participants and for identifying those performing at best-in-class levels.

360-DEGREE RESEARCH: SEEING ORDER IN THE CHAOS

About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best-in-class positions in growth, innovation and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best practice models to drive the generation, evaluation and implementation of powerful growth strategies. Frost & Sullivan leverages more than 50 years of experience in partnering with Global 1000 companies, emerging businesses, and the investment community from 45 offices on six continents. To join our Growth Partnership, please visit http://www.frost.com.