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Background and Company Performance

Industry Challenges

Clinical decision support systems (CDSS) have evolved from print-based or online referential sources of approved medical guidelines, protocols, drug information sources, and expert supported fact-bases to knowledge-based decision support tools. CDSS enable physicians and other health practitioners to utilize digital technology and connectivity in treating an individual patient on a personalized basis. The underlying value of CDSS in any context is well defined by the “five rights” approach, which states that a CDSS enhance health-related decision making, providing the right information to the right person in the right format through the right channel at the right time when the right information is needed. In the complex maze of healthcare stakeholders, the concept of the right information includes a variety of data sources. As a result, CDSS is not a “one size fits all” resource, as some physicians prefer to have access to CDSS knowledge when confronted with an unusual situation while others believe their experience and training represent the appropriate foundation for decision making.

CDSS has become a blend of technologies offering a real opportunity to accelerate the progress of value-based reimbursements, connected health, and population health management. Furthermore, advanced computing capabilities, such as IBM Watson Cognitive Computing and patient-generated Big Data, in addition to new data streams generated from telehealth systems drive the need for CDSS. Clinical guidelines and evidence-based medicine CDSS are either directly included in electronic medical records (EMRs) or linked to the electronic health record (EHR). As a result, CDSS evolved to become an integral component of healthcare information management systems. However as EHRs have become a core element of these systems, there is increased pressure to make EHR’s interoperable across systems. Furthermore, providers are concerned about the potential for CDSS growing into a repository with too much data, making it difficult to find or access information. Additionally, as medical protocols continuously change, CDSS need to be easily updated or added. Healthcare administrators are also concerned by alert fatigue and prefer systems that include data filters.

Frost & Sullivan research indicates that the overall United States (US) CDSS market totaled $3.24 billion in 2016 and projects it to reach $4.97 billion by 2021, growing at a compound annual growth rate (CAGR) of 8.9% from 2016 to 2021. CDSS market is segmented into four major segments: CDS clinical guidelines and evidence-based medicine, CDS analytics, CDSS medical workflow solutions, and point-of-care solutions. Additionally, the CDS clinical guidelines and evidence-based medicine sector is estimated at $915.7 million in 2016 and will grow with a CAGR of 6.8% until 2021 to reach $1.27 billion. Since the health information technology and economic and clinical health and Meaningful Use became realities, EHR and EMR vendors must either include CDSS data within the electronic record’s properties or offer ways for users to link to CDSS sources or workflow capabilities. Additionally, changes in the way physicians are employed have influenced CDSS utilization. Physicians who are employees of large provider organizations may be required to follow CDSS-based protocols whereas doctors who remain independent may have more personal flexibility.
CDSS will see the most significant growth as a patient surveillance resource available at the point of care. The ability to analyze a range of patient data on an ongoing basis and alert the medical staff to serious issues on the basis of a sophisticated analysis level—beyond the capabilities of patient caregivers—will provide the golden opportunity for vendors. CDSS will evolve into more predictive analytic tools. Emerging machine-learning algorithms, artificial intelligence, and cognitive computing technologies combined with input from a patient’s history, next-generation sequencing, and other patient-generated data, will propel advanced CDSS over the coming decades.¹

Elsevier’s Technology Attributes and Future Business Value

Founded in 1880 and headquartered in Philadelphia, Pennsylvania, Elsevier is a leader in the CDSS market, offering a variety of content sources that integrate evidence-based content into the care process and help improve patient outcomes. The company’s STATdx is the industry-leading diagnosis support system for radiologists. Leveraging its successful design and strategic approach with STATdx, Elsevier created ExpertPath to provide pathologists with diagnosis support. The company designed its solutions by physicians for physicians, ensuring that they are easy-to-use and provide relevant and detailed information to help physicians make an accurate and high-quality diagnosis.

Century-long Physicians Empowerment: Pathological and Radiological Applications

STATdx

Elsevier created its industry-leading STATdx solution to provide radiologists with high quality and detailed data aiding clinical assessment and diagnosis. The STATdx has over 4,300 diagnostic evaluations written by the world’s leading experts in radiology. Each information module contains key facts, terminology, imaging findings, differential diagnosis, pathology, clinical issues, diagnostic checklist, and selected references linked to PubMed. STATdx also contains nearly 1,300 expert differential diagnosis modules based on anatomy, imaging patterns, clinical presentation, or modality-specific findings and over 20,000 supporting individual patient cases that include demographics, history, case description, and author. Finally, STATdx includes over 200,000 searchable images, including x-ray, CT, MR, and ultrasound images.

ExpertPath

After experiencing rapid and substantial success with its STATdx, Elsevier designed ExpertPath to provide the same decision-making support information for diagnostic pathology as STATdx does for radiologists. ExpertPath includes decision support information across various anatomic areas—e.g., neuropathology, normal histology, soft tissue tumors, gynecological, head and neck, kidney, breast, bone and cardiovascular—and clinical segments—including toxicology, medical microbiology, immunology, and clinical chemistry. Elsevier’s advanced ExpertPath has over 4,000 medical overviews and diagnoses written by industry experts and clinicians. The content on the platform varies widely to meet clinicians’ specific needs, and includes:

• Overviews of diagnostic groups, providing clinicians with foundational background information
• Organ-system reference tables summarizing organ systems to provide pathologists organ-specific diagnostic guidance
• Over 51,000 expert-selected pathology images (one of the industry’s largest image databases) generated from an array of staining, imaging, and microscopy techniques—including gross pathology, immunohistochemistry, immunofluorescence, electron microscopy, endoscopic, radiologic, and vivid color graphics—with captions and arrows to identify key features and allow users to easily search for relevant images. Images from both normal and abnormal pathologies aid physicians during the evaluation process and diagnosis.

Expert-written content is written by an expert and supported with references from industry-accepted references, e.g., journals and books, provides critical information aiding an accurate diagnosis—key facts, terminology, summary tables, ancillary tests, annotated images, and differential diagnoses.

Ensuring Ease of Use
Elsevier designed the STATdx and ExpertPath on cloud-based platforms, enabling easy and continuous updates. The company maintains extensive expert teams, guaranteeing that the reference material is the most up-to-date information available. For example, when Zika became a large threat, Elsevier released expert-created content regarding Zika diagnosis protocols 17 days after the first outbreak. With its extensive content volume, Elsevier designed STATdx and ExpertPath to push relevant and easily searchable data to users, ensuring physicians are not overburdened with non-relevant information. Users can perform a targeted search across the platform’s entire content using a variety of keywords—including diagnosis, organs, and disease categories—ultimately ensuring timely access to all of the information needed to make an accurate diagnosis.

Furthermore, Elsevier recognizes that physicians have different expertise areas as well as levels and designed its platform with search limits, empowering users with greater experience to filter results as desired. Results from searches display in a uniform format with bulleted information previews, allowing users to sort quickly through the data and find the best match for their needs. Users can also “pin” their favorite categories to their homepage for repeated access or a quick search within that category. The search interface also allows users to adjust the width of different columns, customizing which columns are more viewable based on their preference. Finally, the platform’s content is available in nine languages—Simplified Chinese, Traditional Chinese, Spanish, Portuguese, Brazilian Portuguese, Italian, German, French, and Japanese—facilitating access to global users.

Strategic Expansion and Customer Support
Elsevier commits to users’ satisfaction; the company has a field service team that helps to onboard new customers. Elsevier holds monthly webinars and has tutorial videos to ensure users are aware of the platforms’ features and can easily navigate the solutions. Additionally, the company monitors how users access content leveraging analytics. Consequently, the company provides information to users accessing the content
ineffectively and instructs them on how to use the platform efficiently for improved clinical utility. Finally, Elsevier continuously solicits feedback from users, ensuring that its platforms have access to content that they need and that the platforms are easy-to-use. Elsevier offers user-dependent pricing, providing the health organizations a high return on investment, as they pay in correlation to the number of users. The company also offers discounted pricing for academic centers. As physicians become reliant upon Elsevier’s CDSS during their residency, they expect the same solutions as they become practicing physicians, heightening the company’s brand equity and bolstering consistent and rapid growth. To date, an estimated 99% of medical centers are leveraging the STATdx platform.

The radiology health segment transitioned to digitalization about a decade ago, while the pathology segment is just beginning the transition. Elsevier is leveraging its successful relationships with STATdx customers to help grow its market presence within the pathology segment with its ExpertPath platform. The company commits to continuous innovation and is developing a reference center that normalizes lexicon across applications, empowering better communication between different specialties. Finally, Elsevier is investigating how to provide radiology image recognition to assist in diagnosis.

**Conclusion**

With the shift to digitalization, clinical decision support systems (CDSS) combine emerging Big Data and artificial intelligence technologies with increasing patient-generated information to provide physicians easy access to relevant information for improved clinical assessments. Elsevier is a leader in the CDSS market. The company’s industry-leading diagnosis support system, STATdx, is an easy-to-use comprehensive platform aiding radiologists in the decision-making process. Leveraging its expertise from the STATdx’s success, Elsevier’s created its ExpertPath—a best-in-class CDSS for pathologists. The company’s commitment to user satisfaction led Elsevier to maintain accurate, continuously updated, and easily searchable evidence-based content. As a result of its extensive customer-centric focus, the company is an innovation leader within the CDSS market.

For its strong overall performance, Elsevier earns Frost & Sullivan’s 2017 Global Technology Innovation Award in the clinical decision support systems industry for radiology and pathology.
Significance of Technology Innovation

Ultimately, growth in any organization depends upon finding new ways to excite the market and upon maintaining a long-term commitment to innovation. At its core, technology innovation, or any other type of innovation, can only be sustained with leadership in three key areas: understanding demand, nurturing the brand, and differentiating from the competition.

Understanding Technology Innovation

Technology innovation begins with a spark of creativity that is systematically pursued, developed, and commercialized. That spark can result from a successful partnership, a productive in-house innovation group, or a bright-minded individual. Regardless of the source, the success of any new technology is ultimately determined by its innovativeness and its impact on the business as a whole.
Key Benchmarking Criteria

For the Technology Innovation Award, Frost & Sullivan analysts independently evaluated two key factors—Technology Attributes and Future Business Value—according to the criteria identified below.

Technology Attributes
- Criterion 1: Industry Impact
- Criterion 2: Product Impact
- Criterion 3: Scalability
- Criterion 4: Visionary Innovation
- Criterion 5: Application Diversity

Future Business Value
- Criterion 1: Financial Performance
- Criterion 2: Customer Acquisition
- Criterion 3: Technology Licensing
- Criterion 4: Brand Loyalty
- Criterion 5: Human Capital
# Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices

Frost & Sullivan analyst follows 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.

<table>
<thead>
<tr>
<th>STEP</th>
<th>OBJECTIVE</th>
<th>KEY ACTIVITIES</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Monitor, target, and screen</td>
<td>Identify Award recipient candidates from around the globe</td>
<td>Conduct in-depth industry research, Identify emerging sectors, Scan multiple geographies</td>
</tr>
<tr>
<td>2</td>
<td>Perform 360-degree research</td>
<td>Perform comprehensive, 360-degree research on all candidates in the pipeline</td>
<td>Interview thought leaders and industry practitioners, Assess candidates’ fit with best-practice criteria, Rank all candidates</td>
</tr>
<tr>
<td>3</td>
<td>Invite thought leadership in best practices</td>
<td>Perform in-depth examination of all candidates</td>
<td>Confirm best-practice criteria, Examine eligibility of all candidates, Identify any information gaps</td>
</tr>
<tr>
<td>4</td>
<td>Initiate research director review</td>
<td>Conduct an unbiased evaluation of all candidate profiles</td>
<td>Brainstorm ranking options, Invite multiple perspectives on candidates’ performance, Update candidate profiles</td>
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<tr>
<td>5</td>
<td>Assemble panel of industry experts</td>
<td>Present findings to an expert panel of industry thought leaders</td>
<td>Share findings, Strengthen cases for candidate eligibility, Prioritize candidates</td>
</tr>
<tr>
<td>6</td>
<td>Conduct global industry review</td>
<td>Build consensus on Award candidates’ eligibility</td>
<td>Hold global team meeting to review all candidates, Pressure-test fit with criteria, Confirm inclusion of all eligible candidates</td>
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<tr>
<td>7</td>
<td>Perform quality check</td>
<td>Develop official Award consideration materials</td>
<td>Perform final performance benchmarking activities, Write nominations, Perform quality review</td>
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<tr>
<td>8</td>
<td>Reconnect with panel of industry experts</td>
<td>Finalize the selection of the best-practice Award recipient</td>
<td>Review analysis with panel, Build consensus, Select recipient</td>
</tr>
<tr>
<td>9</td>
<td>Communicate recognition</td>
<td>Inform Award recipient of Award recognition</td>
<td>Inspire the organization for continued success, Celebrate the recipient’s performance</td>
</tr>
<tr>
<td>10</td>
<td>Take strategic action</td>
<td>Upon licensing, company is able to share Award news with stakeholders and customers</td>
<td>Coordinate media outreach, Design a marketing plan, Assess Award’s role in future strategic planning</td>
</tr>
</tbody>
</table>
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.

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.