MANUFACTURING SIMULATION SOFTWARE

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SIEMENS

"SIEMENS IS A CLEAR LEADER DUE TO IT'S MARKET-LEADING CAPABILITIES THAT BRING FACTORY SIMULATION, PRODUCT DIGITAL TWINS, AND VIRTUAL COMMISSIONING TOGETHER, WHILE BEING ABLE TO LEVERAGE COMMERCIAL STRENGTH IN THE SMART MANUFACTURING SPHERE AND BROAD PORTFOLIO OF INTERDEPENDENT TECHNOLOGIES AND SOFTWARE PRODUCTS. SIEMENS' PRESENCE ACROSS SUCH A DIVERSE RANGE OF SOFTWARE, TECHNOLOGY, AND HARDWARE FUNCTIONS WITHIN THE MANUFACTURING VALUE CHAIN IS A COMMERCIAL ASSET IT LEVERAGES TO NOT ONLY IMPROVE THE EFFICACY OF ITS SIMULATION TOOLS, BUT ALSO THEIR ROUTE TO MARKET."

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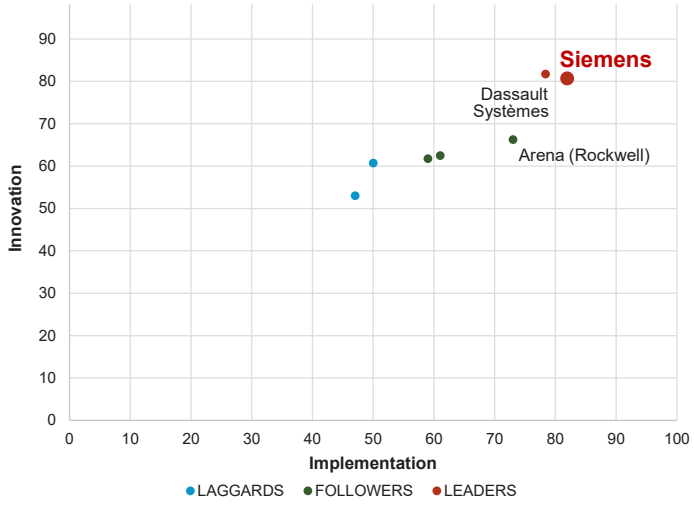
RESULTS



ABI Research assessed Siemens along with six other manufacturing simulation software vendors. The companies were chosen because they account for over 80% of the market in discrete manufacturing simulation software. The vendors included represent a range of company sizes, from major industrial players, such as Siemens, Dassault Systèmes, and Arena (Rockwell Automation), to niche software companies with fewer than 50 employees, such as Simio and SIMUL8. While some of these companies offer general-purpose simulation tools that go beyond manufacturing, ABI Research is assessing their capabilities in discrete production. Companies that specialize exclusively in process manufacturing, such as AspenTech and AVEVA, have strong simulation offerings, but have not been included in this assessment in order to ensure companies are being compared fairly.

Leaders: Siemens and Dassault Systèmes

Siemens and Dassault Systèmes stand out as closely matched leaders, with the former earning the top spot in implementation and the latter leading innovation. These companies are clear leaders because of their ability to integrate factory simulation into the end-to-end process of engineering, design, planning, operations, and supply chain. Both companies have strong Product Lifecycle Management (PLM) offerings, meaning they can synchronize the way products are designed with the way they are manufactured, which results in far greater accuracy when simulating plant layouts and optimizing tooling setups. This continuity across the manufacturing lifecycle also supports both companies' outstanding digital twin capabilities, with Dassault Systèmes performing slightly higher in this criteria due to the strength of its market-leading 3DEXPERIENCE platform, which also

creates a consistent UX and a unified ecosystem for collaboration between multiple functions across the manufacturing value chain. Meanwhile, Siemens deserves recognition for its ability to leverage its MindSphere Industrial IoT (IIoT) platform, which is a fundamental part of the value proposition for its simulation offering due to the volume and quality of data it provides to the simulation process. Siemens also scores highly in innovation due to the virtual commissioning capabilities offered through its Simcenter and PLCSim Advanced tools, which allow manufacturers to go way beyond layout simulation and program their manufacturing equipment based on simulations at the Programable Logic Controller (PLC) and machine level. Siemens and Dassault Systèmes are also the only two vendors in this assessment that do not rely on the external plug-in OptQuest to perform optimization modeling. Both companies instead use their own optimization and modeling tools, developed in-house or gained through acquisition, and therefore, they deserve additional recognition for innovation.

Dassault Systèmes and Siemens also distinguish themselves from others in the implementation category. Both companies, especially Siemens, have successfully made simulation a well-integrated capability not only within their wider company offering, but also within the wider market. While Dassault Systèmes has a higher usership, Siemens offers a more complete set of implementation capabilities, as it more successfully leverages its adjacent technologies. Siemens' presence across such a diverse range of software, technology, and hardware functions within the manufacturing value chain is a commercial asset it leverages to not only improve the efficacy of its simulation tools, but also their route to market.

METHODOLOGY

After individual scores are established for innovation and implementation, an overall company score is established using the Root Mean Square (RMS) method:

$$Score = \sqrt{\frac{innovation^2 + implementation^2}{2}}$$

The resulting overall scores are then ranked and used for percentile comparisons.

The RMS method, in comparison with a straight summation or average of individual innovation and implementation values, rewards companies for standout performance.

For example, using this method, a company with an innovation score of 9 and an implementation score of 1 would score considerably higher than a company with a score of 5 in both areas, despite the mean score being the same. ABI Research believes this is appropriate as the goal of these matrices is to highlight those companies that stand out from the others.

INNOVATION CRITERIA

Digital Twin: This criterion accounts for a solution's ability to bridge the physical (products, equipment, and facilities) and the digital (product models, simulations, equipment virtualizations, and digital plant layouts) along every stage in the production process. Within this criterion, special attention is paid to how well-aligned the software is with real-world conditions; the digital twin's ability to connect engineering, production, and supply chain (digital thread); and the latency between real-world updates and the digital twin. Software that provides an accurate, real-time digital twin that spans the entire production lifecycle will score well in this category, as this ability enables manufacturers to achieve a closed loop between simulations and the real world.

User Experience (UX) and Visual Features: This criterion looks at how usable and functional the software interface is, how well it caters to multiple user groups (e.g., process engineers, production managers, equipment engineers, product engineers, etc.), the quality of Two-Dimensional (2D) and Three-Dimensional (3D) digital images, and capabilities related to Augmented Reality (AR) and Virtual Reality (VR).

Data Ingestion: Effective simulation relies on real factory data to not only assess and validate the reliability of simulations, but also to update simulations with changes that occur in the real world. This real-world feedback should be grounded in real-time operational data taken directly from the production shop floor. The ability to ingest a large volume, variety, and velocity of data from Internet of Things (IoT) devices, networks, and adjacent applications are, therefore, critical judgement criteria because it allows manufacturers to simulate at the machine and equipment level, not just at the higher layout level of a production facility.

Virtual Commissioning and Equipment Support: One of the most fundamental purposes of simulating manufacturing operations is to ensure the performance of physical equipment can be correctly predicted and optimized. A manufacturer's ability to optimize machine performance is dramatically improved if they can accurately produce simulations and synchronize these with actual machine control and equipment programming (virtual commissioning). In addition to providing this link between simulation and virtual commissioning, the strongest simulation tools will also be able to model and support a wide number and variety of machines used on the factory floor. This overall category has been selected due to its impact on first-time-right equipment deployment and Overall Equipment Effectiveness (OEE), both of which translate into major cost savings for manufacturers.

Modeling and Analytics: The best simulation tools can model complex systems accurately and provide prescriptive Key Performance Indicator (KPI)-driven analytics related to critical metrics, such as OEE, machine failure rate, downtime, labor costs, product throughput, and energy efficiency. To achieve this, the software must be able to receive business logic and production constraints as inputs and combine these with accurate, data-driven mathematical models that simulate changes to production layouts, operational capacity, supply chain operations, procurement, and more.

IMPLEMENTATION CRITERIA

Usership: This relates to the number of enterprise clients and individual users of the software. Due to a variety of business models (licenses, subscriptions, bundled software products), the number of clients and users will be considered to determine success in this area.

Vertical Versatility: This category evaluates the software's ability to add value to manufacturing operations across a wide variety of industry verticals within discrete manufacturing. Software products that are used by a wide variety of clients across a range of complex industries and applications score highly here.

Regional Coverage: This criterion assesses the geographical diversity of the software's user base and support networks. Vendors with strong sales, service and support networks, and client bases in diverse national and regional markets will perform well.

Smart Manufacturing Systems Integration: Manufacturing simulation software achieves maximum value for enterprises when it can be successfully integrated with adjacent applications, allowing these companies to implement a more holistic approach to design, production, and supply chain planning. For software providers, this can be achieved through open integration with applications from other vendors or by integrating horizontally across other products within their portfolio. Companies with a strong portfolio of complementary applications or those that form effective partnerships with relevant external technology providers will score well here.

Training, Support, and Consulting: This criterion examines the vendor's service and support offerings. The quality of additional support, training, and consulting, as well as the cost to the customer are taken into consideration.

DESCRIPTION

Siemens provides a broad and complete suite of tools that enable companies to plan, design, test, and optimize production operations in both discrete and process industries. Central to its discrete simulation offering are NX, Simcenter, Tecnomatix, and MindSphere, which together create a fully end-to-end approach to simulation that connects product engineering and design, production planning, manufacturing operations, and supply chain processes together. This approach ensures that manufacturing operations are suited to product design and engineering processes, while ensuring resources and costs are optimized based on real-time data. Siemens manages to effectively leverage its broad software portfolio and capitalize on its market position as a leading smart manufacturing vendor to provide a highly effective manufacturing simulation solution offering.

Above all, Siemens' high performance in innovation is attributed to the quality and quantity of data that feed and calibrate its models, as well as Simcenter's ability to simulate machines and physical tools at the control level, something the followers and laggards are unable to do. This means it creates a truly accurate and reliable digital twin that can be used to program machines and design production layouts based on deep analysis of real-world conditions, rather than purely pre-defined business logic and manually-entered parameters.

Siemens' position atop the implementation ranking is ultimately attributable to its unique corporate structure, which positions it as a software developer, hardware technology vendor, and a manufacturing end-user simultaneously. This provides a more holistic simulation technology and support offering from a commercial standpoint. Siemens is able to effectively leverage its vast pool of talent, knowledge, and resources at every point along the manufacturing value chain, including PLM, automation controls and hardware, CAD/CAM, IIoT, Manufacturing Execution System (MES), and manufacturing operations. Given that successful simulation relies on inputs from as many variables and processes as possible to deliver accurate and reliable models, this wide value chain coverage enables Siemens to deliver its software in a truly end-to-end way that.

Siemens has broad and deep coverage of all manufacturing sectors across both discrete and process industries and has specialized tools tailored for specific industry verticals. This is demonstrated by Siemens' acquisition of Mentor, providing the company with a tool specifically for the simulation of Printed Circuit Board (PCB) manufacturing. Siemens is also able to leverage its vast salesforce and human capital across the world to sell software and provision additional services to customers anywhere in the world with little need for Value-Added Resellers (VARs) in remote markets.

COMPANY	IMPLEMENTATION	INNOVATION	OVERALL
Siemens	81.5	80.5	81.0
Dassault Systèmes	78.5	81.5	80.0
Arena (Rockwell)	73.0	66.25	69.7

COMPANIES EVALUATED FOR THIS REPORT INCLUDE:

AnyLogic	FlexSim	SIMUL8
Arena (Rockwell)	Siemens	
Dassault Systèmes	Simio	

For questions on this research, please contact ABI Research.