Blueshift RESEARCH REPORT

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Ansys in Strong Spot to Benefit From 5G, Chips, and Car Design

Companies: ADSK, ALTR, ANSS, CDNS, DASTY, EPA:ESI, ETR:SIE, PTC, STO:HEXA-B

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Research Question:

What type of growth rate can Ansys deliver over the next few years in the simulation software market?

Summary of Findings

- Ansys Inc. (ANSS) is in great position to expand sales of its simulation software for emerging technology like 5G networks and next-generation vehicles, according to interviews with 12 customers, channel partners, and other industry specialists.
- An engineer for a vehicle maker said his company's spending on Ansys licenses is likely to increase by 25% per year over the next three years because of the design demands for electrification. One Ansys channel partner said he had targeted 25% revenue growth this year prior to the COVID-19 pandemic, while another channel partner said 15% annual revenue growth is achievable, though it will require Ansys to continue its aggressive acquisition strategy.
- Sources said Ansys is the market leader and gold standard in areas like semiconductor design because it offers the broadest set of tools, an easy-to-use interface, and good integration among different disciplines.
- Demand for simulation software is growing as companies realize the high cost of errors once production begins. Trends in certain industries, such as shrinking die sizes in chip design, are also highlighting the value of simulations.
- Demand is most closely tied to R&D budgets, so it does have some buffer from the broader economy. However, it can be influenced by declines in product demand for some companies. Three sources said the COVID-19 pandemic will hurt Ansys sales this year.
- Simulation software is incredibly sticky since it involves a significant upfront expense and specialized training, so there tends to be little share shift among vendors. One source said Siemens AG (ETR:SIE) could emerge as a more formidable competitor if it can better integrate a number of recent acquisitions.

	Quality of Ansys Software	Ansys' Long-Term Growth Outlook	Value of Simulation Software
Ansys Customers	↑	↑	↑
Channel Partners	↑	↑	↑
Industry Specialists	↑	N/A	↑

Silo Summaries

1) Ansys Customers

Spending on Ansys software will increase over the next few years, though there will likely be a short-term disruption because of global economic conditions. **A vehicle manufacturer said his company is in the process of negotiating a new three-year deal with Ansys that should result in a 25% per year uptick in spending.** An engineer with a chipmaker said the increasing complexity of semiconductor designs will lead to more spending with Ansys, while two other sources said **5G networks will boost demand for Ansys' products.** All seven sources agreed that Ansys offers a high-quality set of simulation tools, citing its ease of use and the interoperability of solutions for different disciplines. **Its software is expensive but ultimately provides good value.**

2) Channel Partners

Ansys is well-positioned to grow throughout the world. One source, based in India, said he had targeted 25% growth in his firm's Ansys revenue for 2020. The other source said **15% annual growth for Ansys is more realistic**, though some of that will have to come from acquisitions rather than organic growth through additional license sales. Perpetual licenses are two to two-and-a-half times more expensive than a 12-month lease, with annual maintenance fees of up to 15%, one source said. Over five years of consistent use, the perpetual licenses are a better value, he said. Both sources agreed that **no competitor has as complete a set of solutions as Ansys.** The overall market for simulation software is growing because of the cost savings generated by identifying potential problems early in the process.

3) Industry Specialists

The breadth and depth of Ansys' solutions are unmatched among simulation software vendors. Ansys is benefiting from trends in 5G networks, autonomous vehicles, and the Internet of Things and has developed a leading position among designers of electric vehicles. **A provider of electric vehicle design software said sales have been growing at a 30% to 40% annual clip, but his firm's partnership with Ansys could accelerate that growth to as much as 60%.** Demand for simulation software is connected to a company's number of active projects, one source said. Simulation software is expensive but worth the investment to avoid costly mistakes later on.

Ansys Inc.

Background

Ansys is a developer of simulation software that allows engineers and product designers to digitally develop and test designs before moving to physical prototypes. Its software is used across a variety of industries, such as semiconductors, automotive, and aerospace. Customers include car makers like Bayerische Motoren Werke AG (BMW), defense contractors like Lockheed Martin Corp. (LMT), equipment manufacturers like Caterpillar Inc. (CAT), and chip designers like Nvidia Corp. (NVDA). NuScale Power, a developer of modular nuclear power systems, inked a new seven-figure deal with Ansys in Q1. Ansys offers both cloud and on-premise versions of its software and allows customers to purchase either a perpetual license, a lease license, or a pay-as-you-go elastic license.

Ansys' Q1 revenue of $305 million was down 4% compared to a year earlier, largely due to a difficult comp to last year's Q1, where the company posted double-digit revenue growth. While executives predicted some negative impact from the COVID-19 outbreak on short-term revenue in sectors like commercial aerospace, they said the pandemic should not hurt investments by customers in semiconductors and defense, where spending is tied to long-term R&D budgets. For the full year, the company has projected revenues of between $1.54 and $1.62 billion. At the midpoint, that would represent a 3.5% increase from 2019 after double-digit jumps the two previous years. Prior to the COVID-19 outbreak, the company had forecast an 11% compound annual growth rate that would get it to $2 billion in annual revenue by 2022.

Ansys is sometimes grouped with other engineering software developers like PTC Inc. (PTC) and Autodesk Inc. (ADSK), but its most direct competitor in the simulation software niche is Dassault Systèmes SE's (DASTY) Simulia. Widely used in the aerospace and auto markets, Simulia has been deployed recently to model air flow as part of efforts to minimize COVID-19 cross-infections in hospitals. Dassault has also been promoting Simulia for its antenna array design capabilities, with a focus on 5G small-cell base station antennas.

Ansys says its total addressable market for simulation software, which was about $6.6 billion in 2018, will triple by 2026. The company hopes to benefit from emerging technologies like 5G, self-driving and electric vehicles, and the Internet of Things. It went on a buying spree in 2019 to expand its simulation capabilities, acquiring Livermore Software Technology Corp. for $780 million; Dynardo, a developer of design optimization technology, for $33 million; Granta Design, a provider of materials information technology, and Helic for a combined $261 million; and DfR Solutions, an electronics automation design firm. On April 1, the company closed its $107 million acquisition of Lumerical, a developer of photonic design and simulation tools.

Current Research

Blueshift Research assessed Ansys' sales growth outlook. We employed our pattern mining approach to establish four independent silos, comprising 12 primary sources and two secondary sources focused on Ansys and digital twin technology. Interviews were conducted May 26–June 12.

1) Ansys customers (7)
2) Channel partners (2)
3) Industry specialists (3)
4) Secondary sources (2)

Next Steps

Blueshift Research will pursue more of Ansys' enterprise customers to understand growth rates and spending drivers for its suite of simulation software.

Silos

1) Ansys Customers

Spending on Ansys software will increase over the next few years, according to six of seven sources in this silo, although three noted a likely short-term disruption because of global economic conditions. One source with a vehicle manufacturer said his company is in the process of negotiating a new three-year deal with Ansys that should result in a 25% per year uptick in spending because of the demands of electric vehicle designs. An engineer with a chipmaker said the increasing complexity of

semiconductor designs will lead to more spending with Ansys, while two other sources said 5G networks will boost demand for Ansys' products. Three sources said spending on simulation software is driven by R&D budgets and the number of active projects rather than broader economic conditions, though one other source said consumer demand for his company's products can slow those investments. All seven sources agreed that Ansys offers a high-quality set of simulation tools, citing its ease of use and the interoperability of solutions for different disciplines. Its software is expensive but ultimately provides good value by avoiding costly errors once production has started. This type of software is extremely sticky, three sources said.

Key Silo Findings

Spending Drivers and Outlook

- 6 of 7 said they expect spending on Ansys to increase over the next few years.
  - 1 said his vehicle manufacturing firm is in talks to increase its Ansys spending by about 25% per year for the next three years to meet the demands of electric vehicle design.
  - 2 said the development of 5G networks will drive increased spending on Ansys.
  - 1 said his semiconductor firm will likely spend more on Ansys because chip designs are becoming more complex and requiring the merger of various disciplines.
- 3 said the coronavirus pandemic will dent near-term spending on simulation software.
- 3 said spending on Ansys is most closely correlated to a company's R&D budget, which is based on its number of engineers and number of active projects at a given time.
- 1 said spending on Ansys is tied to consumer demand for his company's products and, thus, connected to the broader economy.
- 1 said an Ansys perpetual license can cost $60,000 to $80,000, with an 18% annual maintenance fee.
- 1 said Ansys' costs are determined through a highly complex negotiation that takes into account product roadmaps, number of users, and how much use the software will get.

Trends in Simulation Software

- 7 said Ansys offers a high-quality set of products.
  - 4 cited its ease of use and well-designed interface.
  - 2 said Ansys stands out because of the easy interoperability between its different types of simulation tools.
  - 1 called Ansys the gold standard in the semiconductor industry.
- 5 said it is not difficult to justify the high cost of an Ansys license, as the software provides good value.
- 3 said it is rare for companies to switch from one simulation software vendor to another.

1) Design analyst for a motor vehicle manufacturer

This source's company expects to increase its spending on Ansys software by about 25% per year over the next three years because of the demands of electrification. It is not difficult to justify the increased spending: More simulation work saves time and money by reducing the need to create many prototypes. The savings could double the spending on the software. Ansys' acquisition strategy is paying off as it is easier for customers to exchange data between different simulation systems. Simulation software is very sticky and it is rare for users to switch vendors.

Spending Drivers and Outlook

- "We have 10 [Ansys] licenses currently for mechanical behaviors. We also have a couple of licenses to simulate fluid phenomena, such as engine cooling and combustion. We also have some specialized accessory licenses for running Ansys on big computers. This allows us to exploit their full potential. We also use simulation software from some of their competitors on top of that."
- "Last year, we spent [a little] under $200,000 on Ansys for the maintenance fee for all the licenses we have. In general, the yearly fee is 20% of the overall value of the software."
- "The cost has not gone up much in the last five years. We reached an agreement with our distributor and paid extra to transform medium-range licenses to top-level ones. There are different levels of licenses at different prices. But we didn't increase the number of licenses."
- "We're now in discussions with our distributor about Ansys in coming years. We're getting ready to expand our portfolio as, like many other companies in this sector, we have to get more involved in the electrification process for

many of our brands. We have to adapt to the current market. We are looking at the modules Ansys offers that simulate electrical systems, coupled with the mechanical ones."

- "This increased use will cost us more than 25% more per year. We have a very complex proposal from Ansys. For that extra spending annually for three years, they are offering a wider range of products that will allow us to increase the number of licenses we already have, use what we have more extensively, and we can expand the simulation power in different fields, such as electrification. At the end of the third year we can purchase some of the products we've been trying, if we find them useful, at a special price."
- "Spending on Ansys could be influenced by swings in the economy. It's important for users to explain to the CFO that by spending money, you're saving money in other sectors. I could, for example, demonstrate the extra spending will help us save twice as much by saving on prototypes and on time. It will even let us explore more characteristics and features of our new products to give us more opportunities to be more successful. It would be shortsighted not to do so."

Trends in Simulation Software

- "Ansys paved the way for a new approach to the process of simulation. They redesigned the graphical user interface. That's the interface you see on the computer screen when you interact with the product. It's crucial. Depending on how well organized the interface is, you can save a lot of time in the preparation of your models. The quality you can achieve for your models is much better. Ansys was first to introduce this new kind of human computer interface. It changed the market for everybody."
- "Along with this new approach, they were able to integrate many different disciplines into the same interface. When you combine disciplines you can deal with different problems, such as the engine not breaking but also the engine not heating up excessively. These kinds of things require different simulations. The simulations are often coupled. You can do one and disregard the other one, but the exchange of data was historically not easy before because the data came from different environments. Ansys combined the disciplines. They purchased the companies that owned the different software. Now all the different software is under one roof and they can exchange their data."

> **Ansys has managed to keep the robustness and reliability of their products at a very high level even if they've simplified how people interact with their product.**
>
> *Design analyst for a motor vehicle manufacturer*

- "There is a widespread market trend as software makers try to reach out to as many users as possible. Some of the products achieve their targets by oversimplifying. Even with a nice graphical interface, there are some very complex mathematics behind it. It could expose people to building something badly and that would be disastrous. Ansys has managed to keep the robustness and reliability of their products at a very high level even if they've simplified how people interact with their product."
- "The CAE [computer-aided engineering] market is more or less mature now. Up until about 15 years ago, CAE professionals were sometimes thought of as witch doctors. Not all companies moved at the same speed in adopting simulation software. At first, simulation software was only used when there were problems, when something broke, didn't work, or was just not good and the designers couldn't find the reason why it had happened. It was hard to calculate ROI [of simulation software] because these kinds of failures did not happen all the time."
- "The real value is when you use these tools before creating the final product. Traditionally, you would design a product that you think will be profitable, build many prototypes—which are very expensive—and then go through a long trial and error procedure. On the other hand, if you design a product and develop a virtual model that can predict behavior, you can highlight all the problems in the early stages of design and the only expense you have is the compute power and the time of the people who carry out the simulations. There are no prototypes and no expensive tests. After a few iterations, you can end up with a satisfying product based on the simulation results. When you build the physical prototype, it has a much higher chance of working properly. It avoids the many trial and error iterations, which are very expensive."
- "BMW developed a complete vehicle without a physical prototype. All the developments were done in a virtual environment. They ended up with a very good product. They only had to build a few prototypes that they tested and those behaved in the same way as in the virtual environment. That saved them a huge amount of money and time."
- "We no longer have to prove ROI [for simulation software]. Nowadays, almost everybody is convinced that the simulation techniques are valuable."
- "I use all the Ansys products that simulate the behavior of mechanical systems, solid bodies. We also use Ansys simulation products at this company for fluid simulations."

- "I've been using Ansys simulation software for about 25 years. This company started using it in the mid-90s. I came later and was not part of the selection process."
- "At a previous job, we used [Hexagon AB's/STO:HEXA-B] MSC Nastran. It was one of the first products of this class."
- "In the aerospace and automotive market, the two dominant products have historically been Nastran and [Simulia's] Abaqus. In other fields, like energy, Ansys is the market leader."
- "When you use a product for a long time, it's hard to switch. You develop a substantial library of models and accumulate a lot of data. Switching to another product would mean having to convert everything to the new product. The only time you would want to switch is when you can't do something with the current product and another software enables you to do that thing or do the same things better."
- "We did have an instance of another department not being satisfied with the performance of a preparation module from Ansys. They switched to [Altair Engineering Inc.'s/ALTR] HyperWorks, which is also widely used in automotive."

2) Senior engineer for a semiconductor manufacturer

Demand for Ansys' simulation software should grow in the semiconductor industry because chip designs are becoming more complex. Smaller surfaces and more noise from components being placed closer together is making chip designing more expensive and giving engineers less time to build and test. As a result, chip builders are relying more on simulation software. In addition, the COVID-19 pandemic that is driving people to work from home has increased demand for semiconductors. Ansys RedHawk and HFSS have established themselves as the leading solutions for this kind of work. This source's company spends millions of dollars on Ansys software for tens of licenses, a negotiated package of software and usage designed for flexibility and company growth.

Spending Drivers and Outlook

- "We have tens of [Ansys] licenses, many for HFSS and a few for the other tools."
- "Some companies buy perpetual licenses, or they do leases. There is a variety of financial schemes for these licenses. Purchasing one of these licenses flat out is about $100,000 per year. It's very expensive software. We purchased these as part of a massive bundle and through a complicated scheme. It involved deals in the millions of dollars."
- "I believe that amount is spread out over about three to five years. It's a bucket of money for these tools over a certain number of years."
- "I believe the old model was paying an amount for a traditional perpetual license and then you paid a maintenance fee to get updates and support. As organizations grow and the use is not limited to just one or two people but larger groups, it would be too expensive to give a license to every person. They work out deals for a certain number of licenses but not everybody uses them all the time, with potential changes over time. There are discounts bundling them with associated tools."
- "We are a relatively small company, so you can imagine the magnitude of spending on this software for large companies."
- "Our spending on these tools will increase over the next five years, based on my experience and the applications I have used these tools for."

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- "With the advent of 5G and also decreased IT spending because of COVID-19 and everybody working from home, we [as a company] are seeing more revenue and more demand because of the need to increase bandwidth and more need for these types of chips."
- "I think other companies, too, using this type of software for their particular designs, will also increase their spending on it over time."
- "Increasing spending on the software is not as simple as a company saying they want one more license. It's part of a complex deal. For example, Ansys would ask a certain amount for the next few years and in exchange they will split that up amongst the licenses they think the company needs. If the company needs more, they shift the distribution towards that."
- "The usage of these tools is not a consistent 24-hour usage across 365 days. It's very sporadic. When users need these tools, they need a lot and they need all the support that comes with the tools. At most companies, it is very

hard to plan how many products and licenses they will need for the next year. People can guess, but the usage goes up dramatically when they start designing, when they need more help, and when they're doing debug."

- "It's hard to predict. It comes in spurts. That's why the larger companies do this kind of licensing scheme that involves a big pile of negotiated money. This is even the case if there are a lot of competing vendors offering their services and rates."
- "Another factor is the user base that might be used to a certain tool or might have a methodology around a certain tool. Changing things makes it very difficult for the engineers. It's a complicated process where the people making the decisions have to balance how much money they have available to spend, the future roadmap of products, and the install base, along with their experience with the tool and the methodology. They have to consider that all together as they look at what licenses to buy."

Trends in Simulation Software

- "I've been using these tools for my whole career, about 20 years, at different companies."
- "I use a set of several tools from Ansys that have relatively different disciplines. There are products focused on semiconductors, products focused on packaging and board design, and there are also add-ons to their basic software for semiconductors."
- "I use Ansys RedHawk [formerly owned by Apache] for power delivery for semiconductors and I also use Totem. I also use Ansys SIwave and HFSS 3D simulator for packaging and PCB [printed circuit boards]."
- "The main pro for Ansys simulation software is that some of their key tools, specifically RedHawk and HFSS, are the gold standard for most engineers in the industry. There's a variety of other tools, but not all engineers have the time and patience to academically compare and verify their performance. The tools are too expensive and there's a shortage of time when you're trying to release a product at the same time. This kind of comparison gets vetted out by academics and at industry conferences. We also rely heavily on the vendors to substantiate their claim."
- "Over the last 15 years, RedHawk and HFSS have constantly been the leaders in this kind of work for PCB and packaging. Engineers refer to these tools and they don't want to move away from them."

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> *Senior engineer for a semiconductor manufacturer*

- "I use these tools for doing system-level simulations for chip design. Historically, these tools were used in silos, essentially in chip design for semiconductors and on the system side for PCBs or packages."
- "There's now been a trend to combine these tools and require the two disciplines to merge. That has driven the need for more interoperability between the tools. Ansys is a collection of a variety of companies that had software. Over time, they've integrated everything together."
- "In general, as computers and chips speed up, there are more electromagnetic problems because, as things get smaller and faster, you get more noise from signals that are placed too close to each other. The power also becomes more important, as everything is smaller and we're trying to pump more power through a smaller space."
- "That's the trend in general for semiconductors and chip design and also for the hardware side. Everything gets smaller and faster. It then becomes substantially more expensive. It's a couple of million dollars to do an average chip design for the initial mask. This means there's no time to build it first and then test it. You have to rely more heavily on simulation."
- "You have to make sure the simulations are predicting success of the chip before you make it."
- "The con side of Ansys tools is that they are extremely expensive. It can get hard for managers to justify. It can be hard to explain the cost of future problems and the resources needed to fix future problems. It becomes better to pay up front and be confident in the design before you release it to be manufactured. That's what these tools are for."
- "We use some of the competing tools. We use them when there's a specific need case and they allow us to do the specific things we're after. Cadence [Design Systems Inc./CDNS] is one of the competitor companies. Using their tool seemed alien at first when I compared it to Ansys SIwave, because I was more used to that flow interface. But after a while, I could do things faster. It does the same thing, but the setup process took a long time. [At a previous company], I was able to crank out 45 different designs in a year using the Cadence tool."
- "Some of the other tools can be better in different ways. Some have more advanced development in electrothermal analysis, while the Ansys tools do that in a different way. But, as engineers, we don't have time to verify every single difference."

- "Early on, when signal integrity was becoming a thing, it was difficult to justify a $100,000 license when it wasn't part of the design process. As signal integrity became a thing, more papers were presented and using simulation software became established practice for hardware and chip design. It became easier to justify."
- "I've found that it's easier for companies to justify when they've gone through a big problem."
- "The tools help you find problems that [otherwise] you can't find until you make the product and you run them in a certain way and at a high frequency or a certain mode."
- "For companies that have not gone through the pain of trying to figure out what's going on with their product and having lost money that way, it's very difficult to justify. Companies that have gone through it understand that it's a critical need. They can justify it easily."

3) Senior sales executive with an electrical engineering firm specializing in telecommunications

Demand for a vast array of simulation software, including Ansys, will continue to grow in the wireless telecommunications industry. A key driver is the industry's transition to 5G and the vastly different technical issues involved. This engineering company will buy more licenses from Ansys and other simulation software vendors, partly to accommodate engineers working from home. Large multinational corporations are also likely to increase spending.

Spending Drivers and Outlook

- "A company our size would get at least three or four [Ansys] licenses a year. Bigger companies would get more like 20."
- "Spending on Ansys is definitely not going down [in telecommunications]. We'll require more licenses in the next two to five years for sure."
- "The technology from companies like ours that do the modeling is getting better and better, and accurate measurements and modeling make simulation far more efficient."
- "With 5G, the way we build the network is completely different [to previous networks]—the hardware is different, as is the type of modulation. And now, instead of being able to do measurements [for a model] in a day, you need at least three or four months to do measurements. This means that people are moving more and more towards simulation, because measuring is expensive—it involves assets, people, hardware."
- "Because of 5G, companies are requesting more and more applications for simulation software."
- "If I'm Nokia [Corp./NOK] or [Telefonaktiebolaget LM] Ericsson [ERIC], I need to make base stations and now it's 5G base stations, which is a different standard, so they will go looking for the right devices to build the new infrastructure."

> **Spending on Ansys is definitely not going down [in telecommunications]. … Because of 5G, companies are requesting more and more applications for simulation software.**
>
> *Senior sales executive with an electrical engineering firm specializing in telecommunications*

- "Supplier number one may have the antennas, amplifiers, and everything, and claim to have certain performances. But Nokia or Ericsson will have myriad situations where performance in those varying situations will also have to be known, because they want to make sure that if they buy five million of these devices, they're going to work. These suppliers will then look for the right model and measure the device once—which we do—then they give that model to Nokia, which designs based on the model and tests it, and then do the simulation. So they only need to measure the final system."
- "The problem is, when we talk to these big guys like Nokia, Ericsson, Qualcomm [Inc./QCOM], they all want to use different software to simulate different things. So it's $100,000 here for one kind of simulation software and another $100,000 there for a different kind of software with another function. And then I can't make any of the software talk to each other. That's the biggest challenge. It's like having four engineers talking their own languages, and each one makes a report in his own language."
- "What we're trying to do is build models that will enable all the simulation software to talk to each other."
- "There will be some cuts in R&D [as a result of the economic downturn] and this will result in some cuts to budgets for simulation software. In our case, Ansys will not take a big hit as a result of COVID."

- "The first thing that COVID-19 pushed is the trend to work from home. If I work from home, I need more licenses for my engineers. So, for us, as a small company, we have to buy more licenses to provide people licenses to work from home. And the beauty of simulation software is that you can work from anywhere."
- "The development around 5G, everybody is still doing R&D. The number of licenses we need will be the same or more. COVID-19 will hurt many companies, but I don't think the software companies face a big risk."
- "Our company will spend more on Ansys licenses. We haven't cut manpower [as a result of COVID-19] and we are actually hiring. The measurements side of our business has been put on hold, but simulations have been continuing."
- "When you buy a license [from Ansys], it is normally perpetual. The only thing you buy after that is a yearly support contract, because [Ansys] has a lot of new versions and updates and the technology is evolving. You can't stay with the three- or four-year-old model that you had in your simulator and try to simulate new stuff."
- "Ansys licenses are about $60,000 to $80,000 each, minimum, and you have to pay 18% each year [on top of the original seat cost] for support. So that's one seat. And if you miss one or two years of support, you have to go back and buy a new license. You can opt out of the support, but after two years of not supporting a particular version, you then need to buy a newer version."
- "Ansys is a really strong company. Their biggest competition was [Simulia's] CST, but that was acquired by Dassault, and there hasn't been a bigger competitor since."
- "The advantage Ansys has [over Simulia] is that Dassault's focus is huge systems for jets, for ships, for the army and navy—contracts worth millions, if not billions, of dollars, so they are used to huge deals. [Simulia's deals] are peanuts compared to other parts of [Dassault's] business, and this has meant Ansys has been able to get an edge by providing superior support."

Trends in Simulation Software

- "We use Ansys HFSS. We also work with Dassault, [Keysight Technologies Inc.'s/KEYS] ADS and EEsof, Cadence, and MATLAB, from a company called MathWorks."
- "I've been in this field for 25 years and started with HFSS when it was owned by a different company."
- "Different software tools are better suited to specific things. Firstly, there is the user interface. Whenever I need to simulate 3D structures, I use HFSS. Most people will do the same because they started using it in university and it was free. You don't want to learn a new kind of software for 3D simulation when you already know HFSS."
- "Simulia is [suited to] the mechanic aspects of simulation—if you have a bridge or a plane and you want to know if the wind is coming from this or that direction, how will the wings behave."
- "There's another company in Germany, IMST [GmbH] and they do a very good software installed in many places in the world. It's cheaper than Ansys and it does even better, in my opinion, in terms of the size of the simulations it can do. It's actually about 60% of the price of Ansys."
- "The only reason why a company would change or accept another software is if you prove to them that what you want to do is not possible with [the one you already have]."
- "Ansys has its strengths, and that is 3D simulation structure. HFSS is its flagship tool. But if you want to simulate an electric circuit, you would not use HFSS, you'd use ADS. It depends on what you want to do. You won't be able to simulate all the structures and all the problems. Each one has its strength. They all have different modules, and each one is known for its best module, its flagship module, and the rest is just because they have to have something to compare to the others."

4) Power and control systems engineer

A lot of Ansys customers will be in wait-and-see mode this year because of uncertainty around the global economy. The electric car market is seeing a downturn, which could result in reduced license sales for Ansys. Demand for the same tools in telecommunications, however, is likely to rise as the industry moves to 5G. Simulation software demand is mostly driven by the number of projects in motion and the number of engineers involved in those efforts.

Spending Drivers and Outlook

- "In automotive right now, there's a slowdown, so I would expect all the large automotive companies to be buying fewer Ansys licenses for [designing] electric vehicles."

- "In my area of focus, which is using electromagnetic for designing motors for electric vehicles, we will probably see less demand compared to the previous year [for simulation software]. I can't see GM [General Motors Co./GM] or Ford [Motor Co./F] buying more Ansys licenses [this year]."
- "But for 5G, for example, which also uses electromagnetic, [Ansys] is selling more to that industry, so you need to look industry by industry."
- "In my current role, we will stay flat [on the number of licenses]. Our company will do some evaluations to see what is going to happen to the economy. Also, there is an election, and we don't know what will happen after that. So for me right now, everything is in a holding pattern."
- "There is a hiring freeze in the job market; companies are not laying off people [en masse], but they aren't hiring either that much, especially in my area of electromagnetic design. It's really hard to say what's going to happen in eight months."
- "[When companies] add engineers, they add more software. That's a consistent relationship [in terms of what drives the purchase of more seats]. Each additional project would generate the need for another license; with two projects, they'd have two people [and so two licenses]."
- "If the economy slows, the number of projects will slow. So [Ansys] is going to have fewer engineers [to sell to] and fewer licenses."

Trends in Simulation Software

- "I've mainly used the electromagnetic design set [in the Ansys product suite]. Until last year, I was using Ansys for almost nine years [in previous jobs]."
- "In my current role [leading a design team for an electric vehicle company], we started with Ansys Maxwell and now we are using Altair Flux. We switched because of the cost; Flux was a bit cheaper than Ansys."
- "We have only 20 full-time engineers and the rest are contractors. Only two of us were using Ansys Maxwell, so it wasn't a big deal to switch over. This is very different from my previous two companies [which were large global operations]. They didn't care that much about the price; they will stay with Ansys because they've already invested with the engineers to learn Ansys and switching is very difficult."
- "I am seeing Altair Flux building momentum. They are doing a lot of advertising. After I get used to using the software, after one or two years, if I move companies, I'm probably going to want to stay with Flux and I'll ask for this software. Right now, I don't like the software at all because I'm just learning it, but after two years I'll probably want to stay with it."
- "I'm also interested in knowing more about Siemens' software package for electromagnetic simulations. To me, looking at what they are offering, they look like they could catch up to Ansys."
- "Ansys has definitely been dominating the market. It has most of the tools a company needs. When you buy the electromagnetic package, the mechanical group will need to do work on your electromagnetic design and Ansys will come and sell you another package for the mechanical work, which will link to the first package."
- "It's easier to put in another Ansys package if you've already got one and link the two, and that just grows into the company. In a company like [the large enterprises I previously worked for], you have to design products from an electromagnetic side, a thermal side, a mechanical side, from vibration, from everything. Software like Ansys will provide all of it."
- "To design a product now, you [almost always do] simulation in the beginning to reduce the cost and all of the risk you're going to have in the product. And for those companies that already have a product, simulation is increasingly being used to optimize that product. It's a huge cost saving."

> **Ansys has definitely been dominating the market. It has most of the tools a company needs. … you have to design products from an electromagnetic side, a thermal side, a mechanical side, from vibration, from everything. Software like Ansys will provide all of it.**
>
> *Power and control systems engineer*

5) Engineer for a major global engineering company

Spending on Ansys at this source's firm has been gradually increasing for almost a decade. The coronavirus, however, will dent that spending this year and possibly for as long as the next five years, given the probability of a global economic slowdown. Spending should eventually pick up again, and the long-term outlook is quite rosy. Ansys' strengths are that it

is easy to learn and has a big user group, good documentation, and online learning. It is expensive and the licensing options are poor, but Ansys is a superior software and generally worth the money.

Spending Drivers and Outlook

- "I think long-term future use of software like Ansys will increase exponentially."
- "We spend around $144,000 per year on maintenance costs—license updates. We have six to seven main licenses, plus geometry licenses and HPCs [high-performance computing licenses]."
- "Our spending on Ansys products has increased slightly each year for the last eight to nine years, until four to six months ago. Since then, the spending has quite significantly decreased, due to COVID-19 and our merger with another company."
- "For the near future, I would expect the Ansys-related expenses to be kept to a minimum and am not sure when it might start to increase again. I think our company will be significantly affected by a global recession in coming years. This will reduce the amount of work that needs to be done and the need for Ansys."
- "After five years, I think Ansys spending will go up [as the economy recovers]."
- "[Ansys spending is driven by] the amount of active projects and R&D budgets. The availability of experienced engineers who can use the program in an efficient way also is a factor. It's not so much tied to revenue in our case."

> **I think long-term future use of software like Ansys will increase exponentially.**
>
> *Engineer for a major global engineering company*

Trends in Simulation Software

- "I've been a dedicated Ansys user for 13 years. I'm mainly using Ansys Mechanical Workbench, SpaceClaim, DesignModeler, and Ansys Mechanical APDL. My specialty is within the fatigue of metals area in the mining and aerospace sectors."
- "I was educated in [Simulia's] Abaqus, but the first client I worked for as a consultant only owned Ansys."
- "The pros of Ansys: easy to learn, a big user group, and good documentation and online learning."
- "The cons: it's expensive and the licensing options are bad, even though they've been getting better lately. For small add-ins, you need extra license capabilities. Another example: you buy ridiculously expensive HPCs and then they don't work with certain element types. This is only noted when checking the solver output file as 'GPU disabled because blah, blah, blah.' That's a bit frustrating."
- "Just recently they've allowed you to solve on more cores with only basic license options, so that's a step forward. And things in this business are changing so fast that it's hard to keep up to date. Some things I'm experiencing as a problem might already be sorted if you're buying new licenses as of today."
- "In a sense, [Ansys' software] is too easy to learn—rubbish in equals rubbish out. That perhaps lowers the overall quality in our field."
- "In any case, I think Ansys is a brilliant software and worth the money in most cases. The support here in my region of Australia is really good through a company called LEAP."

6) Former engineer for an engine and battery manufacturer

Spending on Ansys is related to consumer demand for the company's products and is, therefore, heavily dependent on the overall economy. Ansys' software is easy to use and provides better results than Simulia's Abaqus for simulations involving parts in contact. Revisions and post-processing capabilities with Ansys have been problematic.

Spending Drivers and Outlook

- "The spending [on Ansys] has gone up in the last five years, but that's because of Ansys' price increases, I think. Our boss was pretty careful about regulating use of Ansys."
- "[Future spending on Ansys] depends on demand for our products. Our engines and batteries go into consumer products. So anything that affects the economy, companies, and consumer budgets has an impact on demand."
- "The overall economy determines demand for our products, along with the weather, as many of them are used outdoors."
- "To be sure, there wasn't much pressure on us to justify the money we were spending on Ansys. It seemed like upper-level leadership saw its value."

Trends in Simulation Software

- "I started using Ansys as a graduate student in 1983. I like Ansys products. They're robust."
- "All seven of us in the simulation group used Ansys. Four of us used Mechanical Enterprise, one used LS-DYNA, and two others used Fluent. There were some casual users outside the simulation group, too."
- "We started using Ansys four to five years ago. A new manager came in who had used it quite extensively. His larger vision was to extend simulating analysis beyond the seven of us. Ansys seemed the best to hand off to casual users."
- "One Ansys strength is its ease of use. You can easily modify the geometry, put your parts together surface by surface, put your loads on, and go. That's hugely beneficial to us."
- "The results we got on [Simulia's] Abaqus when two parts were in contact never really worked out. We had to read into the tea leaves as to what kind of contact there was. With Ansys, we always got a nice contact pattern."
- "As for negatives, [Ansys] put in a bunch of revisions from where we started. The models worked great for a couple years, and then we had issues. It changed the way they defined contact between surfaces. We couldn't figure out how some surfaces should contact."
- "We battled that for months. We went through support. But the fixes worked on only some of our models. The parts I worked on had to continue to be accessed on the old version."
- "Also, all seven of us didn't like the post-processing capabilities. They weren't as broad ranged as they could have been. If you take the results of Ansys and put them into Altair HyperView, it's a lot more user friendly."

7) Engineer for a tier one automotive supplier

This source's company has not increased its Ansys spending much in recent years but that could change with the release of Ansys' Discovery Live product, which looks very promising for the automotive industry. License and hardware costs would increase current spending by about 50%, were the company to adopt it. Spending on Ansys is somewhat insulated from economic fluctuations.

Spending Drivers and Outlook

- "We have five [Ansys] licenses in Mechanical, Fluent, SpaceClaim, and Multiphysics."
- "We spend under $50,000 annually."
- "Changes in spending are driven mostly by the total R&D budget. Other reasons include specific situations, such as no longer needing a specific module."
- "Spending on Ansys is insulated from swings in the economy. Many core simulations are dependent on existing licenses. Unless a certain simulation is never going to be required, the license remains."
- "Our spending on Ansys has increased a bit, but not drastically."
- "I do expect our spending to increase over the next five years. In particular, and from my experience, Ansys Discovery Live is very promising for the automotive industry. It is new and I don't use it yet."
- "Getting a license for it would be extra. From my understanding this module requires quite sophisticated and advanced hardware that I do not currently have. That would be an added cost."
- "If I were to request it, I would have to make a strong case because it would be not only for myself but five others on my team. They would also need licenses and hardware. I would say spending would increase by almost 50% if we added such products that not only come with high licensing costs but also rely heavily on hardware."

Spending on Ansys is insulated from swings in the economy. Many core simulations are dependent on existing licenses. Unless a certain simulation is never going to be required, the license remains.

Engineer for a tier one automotive supplier

Trends in Simulation Software

- "I use Ansys Workbench. I've been using it for two years. It is widely used within my team and this makes it very accessible for my work."
- "Previously I used Abaqus."
- "Ansys has a friendly UI [user interface], a healthy combination of manual coding and preprocessing as well as automatic settings. The Ansys Learning Hub is really good. Their training material is very thorough."
- "The cost is a con. There are also too many new versions released in a year."
- "Ansys is definitely good value."

2) Channel Partners

Ansys is well-positioned to grow throughout the world, according to both sources in this silo. One, based in India, said he had targeted 25% growth in his firm's Ansys revenue for 2020. Although that goal is likely to be missed because of the COVID-19 crisis, Ansys should be able to deliver annual revenue growth of 20% once the economy improves. Sales of simulation software in India had been growing at a better-than-20% annual clip prior to the coronavirus outbreak and has outpaced other types of engineering software sales. The other source said 15% annual growth for Ansys is more realistic, though some of that will have to come from acquisitions rather than organic growth through additional license sales. Perpetual licenses are two to two-and-a-half times more expensive than a 12-month lease, with annual maintenance fees of up to 15%, one source said. Over five years of consistent use, the perpetual licenses are a better value, he said. Product orders are a key driver of simulation software needs, so demand can be affected by global economic conditions, both sources said. One noted that Siemens has made a number of acquisitions that could make it a strong competitor to Ansys if it is able to integrate them well. Both sources agreed, however, that no competitor has as complete a set of solutions as Ansys. The overall market for simulation software is growing because of the cost savings generated by identifying potential problems early in the process, both sources said. The design demands of self-driving cars—particularly for sensors and signal processing—is boosting demand for simulation software in electromagnetics and optics.

Key Silo Findings

Spending Drivers and Outlook

- 2 of 2 said Ansys is in a good position for sales growth globally.
  - 1 said 20% annual revenue growth is a reasonable target, especially if the company spends more on marketing.
  - 1 said Ansys could hit 15% annual growth, though it will need to continue to acquire companies and their technologies to hit that number.
- 1 said his company had targeted 25% growth in sales of Ansys software for 2020, though the coronavirus pandemic will likely wipe all of that out.
- 1 said simulation projects have been put on hold and new Ansys sales leads have dried up because of the global economic slowdown.
- 1 said sales of simulation software in India, in particular, were growing at a clip well above 20% before the recent slowdown, driven by government spending on defense technology.
- 1 said perpetual licenses from Ansys typically cost about 2.5 times a 12-month lease license. The annual upkeep fee for a perpetual license is about 12% to 15% of the license costs.
  - Perpetual licenses work out to be less expensive over five years but require a bigger upfront investment.
  - Clients in India and Asia tend to choose perpetual licenses over leases.
- 2 said sales of simulation software are closely tied to a company's product orders and, thus, the overall economy.
- 1 said Ansys has the largest global academic program, which boosts sales later because engineers are familiar with its products.
- 1 said Siemens has made a number of key acquisitions of simulation software technologies that could make it a formidable competitor when it figures out how to integrate them, something that could take three to seven years.
- 1 said it is very difficult to shift companies from their current product, whether it is a competitor or an in-house solution.

Trends in Simulation Software

- 2 said the broad applicability of Ansys' platform is its biggest strength, as no competitor has such a complete set of tools.
- 2 said the market for simulation software is growing rapidly as companies realize the high cost of an error once they have gone into production.
  - 1 said simulation software growth is outpacing that of computer-aided design (CAD) or product lifecycle management (PLM).
- 1 said the biggest growth in Ansys sales is in optics and electromagnetics because of the demand designs for self-driving cars and signal processing.
  - Architecture and building design is another growth area.

1) Ansys reseller based in India

This source's firm had targeted 25% year-over-year growth for its Ansys software sales in 2020 but sales will likely be flat because of the coronavirus crisis. However, Ansys should be able to hit 20% growth rates or more in the next few years, especially if it beefs up its marketing spending. Clients in his region tend to prefer perpetual Ansys licenses rather than year-long leases. A lot of the buying decisions are based on an engineer's comfort level with a particular software, so Ansys' global relationship with universities is a big advantage. Siemens is shaping up to be a formidable competitor to Ansys once it integrates the various simulation tools it has acquired in recent years.

Spending Drivers and Outlook

- "Ansys has been trying to achieve a growth rate of 20% overall but, from a global economic standpoint, they have on average been able to manage about 15%. Whenever they have fallen short of that 15% to 20% growth rate, they have acquired companies."
- "Every three or six months, they've bought one company or another. For example, Ansys bought Livermore Software, which is the largest brand for crash simulation. The acquisition strategy has been very much geared to sustaining that 15% to 20% growth rate."
- "We sign an agreement [with Ansys] every year for what our sales target will be. That number is about 25% higher for 2020 than 2019. However, I'm anticipating that that entire growth will be wiped out because of the pandemic and general global economic conditions."
- "I think [our Ansys software sales] will remain flat for this year."
- "India was definitely growing at a rate of more than 20% before the pandemic. Simulation is definitely growing faster than other engineering software segments like CAD or PLM."
- "What I'm hearing is that most multinationals are taking out their contractors [because of the coronavirus crisis]; permanent hires are intact, but for most multinationals about 15% to 20% of their staff are contractors and they've been told that their contracts have been terminated or they will remain suspended for three or four months."
- "This means, of course, that the usage [of simulation software] goes down, and the need goes down, and product development cycles stretch. This means that [our 25% sales growth target] will not happen."
- "The one compensating element is government spending in India—mainly defense technology, which has increased. But it's nowhere close to what private industry consumes."
- "[Beyond this year], Ansys is in a very good spot. I think if they push hard they can achieve growth of more than 20%. In my opinion, they don't spend enough money on marketing. If they spend more here, I think they can grow the overall business 20% globally."
- "A lot of [our region's] simulation software consumption happens because of demand from the rest of the developed world. One might think that Asia wouldn't consume as much simulation software as the U.S. or Europe, but actually it's very neck-and-neck. In fact, Asia is slightly ahead."
- "Larger accounts and opportunities are handled by Ansys but there is no hard-and-fast rule. If we can demonstrate the relationship and technical ability, they do allow [channel partners to handle larger deals] on a case-to-case basis."
- "In our region, this particular software is played like a capital item. [Our clients] essentially want to buy a perpetual license, which will keep on running, irrespective of whether they maintain it or not."
- "You can either license the software [in this evergreen way] or as a 12-month lease. You can start from tomorrow, say, for 12 months—and after that, it will stop working. It will cost X dollars depending on the choice of modules."
- "The other option is to buy it perpetually, which means that the version you are buying—let's say the 2020 version—will keep on working forever, on that particular machine. After 12 months, there is a pre-agreed maintenance cost, and if you pay that maintenance cost, then the next version will also be given to you, and you can keep on using that 2021 version as long as you want."
- "The cost differential between these two versions is always up for negotiation, but a perpetual license is typically 2.2 to 2.5 times [more expensive than] the annual license. The annual upkeep fee for perpetual [license] is about 12% to 15% [of the license cost]. Over five years, perpetual will work out cheaper but needs higher upfront investment."

> **Ansys is in a very good spot. I think if they push hard they can achieve growth of more than 20%. In my opinion, they don't spend enough money on marketing. If they spend more here, I think they can grow the overall business 20% globally.**
>
> *Ansys reseller based in India*

- "In our region, customers favor the one-time [perpetual license] fee because, if in any economic year there is a downturn or difficulty, if the bosses don't approve the budget, then at least the current version will keep on working. That's the nature of the business in our region. I'm aware that in the U.S. and in more developed countries people are now using it even on an hourly or a monthly basis. We don't see that [with our customers]."
- "In my opinion, there are two drivers [of spending on simulation software], at least from the standpoint of our region, which I witness on a day-to-day basis. Firstly, if [our industrial clients] are receiving any large orders from overseas—let's say a German manufacturer wants to manufacture a certain amount of their supply chain from an Indian manufacturer—there will be more spending on simulation [from our client]."
- "A second scenario is where you're competing with a company that invests in a certain piece of software that you find out about—then you want to do that as well, so your competitor doesn't have an unfair advantage over you."
- "The decision [of which software to use] is primarily influenced by the person who is going to be made responsible for using the software. Many times this comes from the person using a certain software from his college days. It's not necessarily a very logical decision-making process outside of this. He'll tell his management, 'I'm comfortable with X software, and I want to buy that.'"
- "It's why all the software companies give their tools free or heavily discounted to universities. Most of these companies now have a joint program with universities. They're trying to penetrate from that perspective. I feel that Ansys definitely has the largest global academic program. I haven't seen any as big as theirs anywhere."
- "Over the last five years or so, Siemens has strategically acquired all of the significant competition of Ansys. [Siemens] has been buying the entire software development and IP holding companies. They've spent a huge amount of money. I'd estimate around $10 billion [on these acquisitions]."
- "So far, they have lacked the vision to integrate all of these bought companies into a single kind of platform. They call it Simcenter, but in reality these are discrete products under that marketing umbrella."
- "One advantage Siemens does have is that, along with the simulations portfolio, Siemens also has a software toolkit which goes on the side of testing equipment. So if, for example, you're developing automotive, there's a simulation side of it and there's also a testing side of it. For all of these test automations, or test compiling, or test data analysis type of software, Siemens has a fairly large portfolio."
- "Eventually, when Siemens can get their act together, they will have a superior offering to Ansys because Ansys is not into testing at all. [For Siemens], this is mostly a management issue more than a technology or cash issue; when management figures out a way to integrate all these solutions, and when we do see a unified approach from them as a competitor [to Ansys], Siemens will be a formidable competitor. This will take three to seven years."
- "[As for other competitors], there is Dassault Systèmes' Simulia, Altair, and another called MSC Software, which I believe has been through a number of buy and sell type scenarios."
- "More than price, [success] has been about industry versions. A number of these products have started in a specific industry and then spread from there. For example, Dassault Systèmes has a product called Abaqus, which was originally non-linear material—everything that's a complex material, Abaqus is going to do well with. For example, in rubber and relatively complicated parts—let's say an artificial heart wall—if you want to do structural mechanics or analysis of a heart wall, an Abaqus type of solution would be preferred over an Ansys solution."

> **They are trying to marry all these [different simulation] technologies into a single solution. And that is where they have the biggest advantage.**
>
> *Ansys reseller based in India*

Trends in Simulation Software

- "We cover all of the Ansys portfolio, from mechanical simulation to fluid mechanics simulation to electromagnetic simulation and more. We're authorized to sell the entire portfolio. As a reseller, I've had a relationship with Ansys for about four years, but I've known these products for my entire career, which is more than 20 years."
- "Ansys is not very strong in any single industry, which is both its strength and its weakness. What they have consciously tried to do is develop and buy companies that are not heavily industry dependent."
- "Ansys is like, if you're hungry and you don't want to think too much, you'll go to McDonald's and buy a burger. Ansys is like the Pizza Hut and McDonald's of the simulation world. If you want to have a meal without putting too much effort into it, they are there and they have a solution."
- "What they're attempting to do now, they are trying to marry all these [different simulation] technologies into a single solution. And that is where they have the biggest advantage. They're trying to ensure that different elements of

physics—for example, structural mechanics and fluid mechanics; fluid mechanics and electromagnetics—[can integrate, whereas right now], their solutions cannot talk to each other."

- "Let's say you're designing an electronics box—a set-top box for satellite TV. A significant function of that box is all the things that happen on the electronics. Ansys will have a solution for the electronics, but also a solution to ensure that it doesn't overheat and stop working. And potentially even in transportation, if it falls off, or because of wind it falls from the roof, it won't break. They're trying to marry these things together."

2) Managing director of an engineering consulting firm and Ansys channel partner in North America

Ansys could see annual revenue growth rates of 10% to 15% through a combination of additional license sales and acquisitions of new companies. In the immediate term, software sales and simulation projects have fallen off a cliff because of the global economic slowdown. In the bigger picture, however, demand for simulation software is growing, especially in areas like auto manufacturing and building design. Simulation software tends to be very sticky, so there is not much switching between competing suites. Many big companies also have built customized solutions themselves, which is another barrier for Ansys to grow.

Spending Drivers and Outlook

- "Our Ansys software sales—we've been contacting people, but nobody is interested. We only can sell in Michigan to smaller companies. Channel partners are prohibited [by Ansys] to work with companies over $500 million, revenue-wise. I can only work with relatively small companies that are making up to around $200 million in annual revenues."
- "Every branch of [our parent organization] is on its own in terms of profit and loss, so I can't afford to pay people to knock on doors if nothing comes out of it and, of course, we need support if we sell the software. I'm thinking of getting out of software because we have to pay our salespeople, our support people—and then the market [Ansys] has given us is not that big; it's not beneficial for me to stay in this business."
- "Overall, Ansys should do well nationwide, but for me—because there are six or seven other channel partners in Michigan—I'm thinking of getting out of software sales altogether."
- "Ansys has said they want to double their growth rate per year, but not based on organic sales; [total sales growth] will probably be 10% to 15%. The growth rate of Ansys historically has been about 7% to 10%, at most, based on organic growth, selling licenses."
- "The other growth they're achieving is by acquiring other companies. For example, they recently bought LS-DYNA and paid almost 12 times the revenue of that company because Ansys knew that they could charge more. Every car industry in the U.S. and automotive company in Europe and Asia are using the software for crash analysis because it's an excellent tool for that. I have no doubt Ansys will do more of these kinds of acquisitions."
- "My [simulation consulting] projects have dropped 50%. Project-wise, we do a lot of [simulation contract engineering work] across the nation, and those projects are on hold. For example, [Fiat] Chrysler [Automobiles/FCAU] comes to us—I can't sell them software, but they will ask us to work on noise reduction for an engine, say. We make a mathematical model of it, see where the source of the noise is, and optimize it."
- "[Another example is] we have big bus companies that buy chassis from other OEMs and they customize the bodies for handicapped people, so we design the body, make sure everything is crash tested. They rely on simulation."
- "All these companies that have projects lined up for us to do, they're not doing them anymore. We work with Chinese customers as well and this year, we got hit. We are almost 50% lower than we expected to be at this time because a lot of companies are not investing right now; a lot of projects that we had have been put on hold until further notice."
- "I'm puzzled. The [stock] market is going up, but some companies we're working with are not even renewing the software. They just want to hold onto it to see what happens."
- "The number of seats companies need is based on economic growth—how fast industry in the U.S. is growing. When people are laid off, it means fewer licenses. In our industry, Ford and GM are laying off people now [because of the economic slowdown]. Right now, we're selling about 15 million or 16 million cars in the U.S., but this could go to 20 million very easily."
- "Siemens, Dassault, and ESI [Group S.A./EPA:ESI] are the three companies that are the biggest competitors to Ansys. Different companies are stronger in various different kinds of physics."
- "For example, in fluid dynamics, Siemens has a good software called STAR-CCM, which competes very well with [Ansys'] Fluent. ESI has OpenFOAM or ACE."
- "If you go to mechanical engineering, [Dassault] Simulia's Nastran comes to the game as the serious competition."

- "Then there are a bunch of mom-and-pop companies that have their own software that were developed 20 years ago and they're maintaining it and companies don't want to let go, because there's a team attached to it, and if you let go of that software, you have to lay off a team of 30 people."
- "A big headwind for Ansys is [how difficult it is] to replace existing software [in big companies]. In our case, what we find is we will get companies whose upper management is very, very enthusiastic [about Ansys software], but they're committed to the competition because they'd already paid for that software, and so we have to give them free software for a while. It's a lot of investment and time to switch a company from one software to another without disrupting their business."
- "Because companies are constantly striving to catch up with the market, they can't park everything for six months to learn a new [software]. It's not possible. Continuity is extremely important and so it's about how you go inside their process without disturbing the status quo and give them your software while pulling out the old one—it's a huge challenge for us. We have to do benchmarking, free training. Sometimes you give them free licenses and often they don't even use it because they don't have time. That's the challenge for Ansys to grow."
- "Ansys and other companies that make simulation software deal with two problems. One is convincing the big companies to let go of their own [in-house] software and buy Ansys or Siemens. I worked for many of these [large companies] before [becoming an Ansys channel partner]. Every company developed their own [in-house simulation] software and the switching costs are a huge issue, because their engineers are used to [the existing software], they're comfortable with it, and they are very reluctant at the lower levels to switch from A to B software—even though B could be much, much better, faster, and much more powerful."
- "Existing licenses within companies are very customized to what the customers do. Ansys doesn't customize for one company; if you have a problem and you want to solve it in a certain way, you have to talk to Ansys and then wait for years before they come and modify it, because they don't want to just do it for one customer. It's why so many companies have their own software."
- "The plus for Ansys is that, because they are not company-specific, they can cater to a wide range of customers in different industries. Their software is more powerful, it's more capable, because it deals with a variety of problems."
- "Ansys' other big headwind is, some companies are already Siemens customers or Dassault customers or somebody else's customers. And [Ansys] in effect has to go in [to these large multinationals] and tell them that their baby is ugly and they should buy Ansys."
- "I don't think any other company has such a complete set of tools [as Ansys does] for all the analyses that are required to design a car, for example. It's a multiphysics approach that's needed. For example, Dassault has Simulia, which is Abaqus. It's very good for mechanical, solid mechanics fatigue, non-linear analysis, but when it comes to fluid dynamics or electromagnetics, they don't have many tools."
- "Siemens, likewise, has some good tools in certain physics, but for other physics, they buy tools from CADFEM, which is basically Ansys."

> **Every big company is resorting to simulation because the savings down the line for tooling and design are so huge. [Ansys'] addressable market is growing because every company everywhere is relying more and more on simulation.**
>
> *Managing director of an engineering consulting firm and Ansys channel partner in North America*

Trends in Simulation Software

- "My company has two parts: a consulting arm, which does simulation projects across multiple industries, and software sales [as an Ansys channel partner]. I am only selling Ansys software. Being in the Detroit area, we sell more mechanical fluid dynamics and electromagnetics [Ansys products]."
- "The market for simulation is growing rapidly. Three or four companies are taking this market and they're all growing every day. Everyone wants some kind of analysis, some kind of simulation behind their design, in a virtual domain, before they invest in the tooling and production—because, when you go that far, a correction is very expensive."
- "Every big company is resorting to simulation because the savings down the line for tooling and design are so huge. [Ansys'] addressable market is growing because every company everywhere is relying more and more on simulation."
- "[The highest growth rate] in sales of Ansys software is in optics and electromagnetics. [The growth in] electromagnetics is because of autonomous driving. A lot of car companies, a lot of suppliers [are developing] a lot of radar and lidar devices, sensor analysis, so they rely on simulating all the electrical and electronic devices and underlying devices for other equipment that is controlled by electronics."
- "For example, I had a [consulting] project for one of the OEMs which has a device in the tires of the car that tells you when the air pressure goes down, so you as a driver get a signal on your dash. All these cars in the highway talk to

each other and so all the cars in your vicinity will get the same signal. How do you prevent that kind of cross-communication in an environment that's all signal based? How do you prevent a hacker getting into the signal? This is the biggest issue that a lot of companies are working on: combining electromagnetics analysis for many reasons, including the signal processing, and they're worried as everything becomes more automated, we are very vulnerable to [hacking]."

- "Optics are dealing with the lighting and using the light to detect objects. Not just visualization, but communication with the computer through light to detect an obstacle on the road or a hole, something that is impossible for a person to see at night, for example. But with electromagnetic light, sensors can detect it."
- "There are also a lot of uses for simulation software in architecture and building design, with designs for lighting in rooms. This software can simulate the light in a computer prior to tooling for parts."
- "[The really big] growth areas are in autonomous driving and signal processing, and things that go to electric and battery and electromagnetic signals and communications and prevention of wrong communication, which is a big deal for companies."

3) Industry Specialists

The breadth and depth of Ansys' solutions are unmatched among simulation software vendors, according to two of three sources in this silo. That broad platform allows Ansys to target mega deals with the world's largest companies. Ansys is benefiting from trends in 5G networks, autonomous vehicles, and the Internet of Things and has developed a leading position among designers of electric vehicles. A provider of electric vehicle design software said sales have been growing at a 30% to 40% annual clip, but his firm's partnership with Ansys could accelerate that growth to as much as 60%. Demand for simulation software is connected to a company's number of active projects, one source said. Simulation software is expensive but worth the investment to avoid costly mistakes later on.

Key Silo Findings

Spending Drivers and Outlook

- 2 of 3 said Ansys is completely focused on multi-million-dollar deals with large companies.
- 1 software provider involved in electric vehicle design said he hopes his company's partnership with Ansys can boost its growth rates from about 35% to about 60%.
  - That will not happen this year because of the pandemic.
- 1 said Ansys can generally be counted on to hit its growth targets.
- 1 said demand for Ansys licenses is most closely tied to the number of projects a company launches in a given year.

Trends in Simulation Software

- 2 said Ansys' biggest strength is its wide range of tools to address all types of simulations.
- 1 said simulation software easily pays for itself when compared to the cost of a failure during production.
- 1 said Ansys is doing well with industries such as 5G networks, self-driving vehicles, electronics, and the Internet of Things.
- 1 said Ansys has carved out a dominant position within electric vehicle development.

1) Director of an Ansys software partner

Demand for simulation software for designing electric motors has been surging and should continue to grow. Sales may be flat this year because of the pandemic, but it does not appear the electrification industry is cutting budgets. Based on Ansys' historical ability to hit sales targets, together with the increased demand for simulation tools globally, Ansys should hit its projected sales growth targets.

Spending Drivers and Outlook

- "The idea with Ansys is that they will be able to sell [our software] at a much larger scale than what we're able to do. We're hoping that the growth rates [of our sales] will be even higher than [the recent 30% to 40%]—60% or something like that. We're at very early stages [of the partnership with Ansys], but that's the intention."
- "There have been two big changes for us in the last year, one being our partnership with Ansys and the other being the pandemic. It's going to be really hard to separate out the two [when it comes to predicting near-term sales]. It's

going to be flat this year. I think the best we can hope for is we have similar income to the previous year—that would be a very good outcome from my perspective, but I'm not going to tell for a while [how this year] will pan out."

- "In our space, I'm not convinced that companies are cutting budgets. If anything, [the pandemic] will accelerate the trend to electrification. I've seen positive aspects and I've seen negative aspects from a business perspective. [The economic slowdown] is not going to be great, but I've seen some things which should benefit us, and so it's possible the overall results won't be too bad in the end."
- "Ansys has a lot of different options when it comes to their licenses. There's a lease, there are paid-up licenses. They have lots of different options to suit different customers, whether that's not quite pay-per-use, but a monitoring of the usage, and then the customers paying based on what they've used."
- "The aim for Ansys is to do the big deals at the high levels in the large companies. That's their real focus, to go to Volkswagen [AG/VWAGY] and GE [General Electric Co./GE] and sell them that full solution across the board at those high levels, and that's where they really get the big value."
- "It's very unusual that Ansys doesn't make its targets. If the target is set, the working assumption is they'll be making it. I would think they probably are on track [to make their sales projections]."
- "Growth rates will be different on an individual product or application area. We're in electrification and we're focusing on electric vehicles and aerospace. Obviously, our growth rates are going to be higher than Ansys as a whole, because there will be other areas that won't grow as fast or even [decline]."
- "One of the reasons [we partnered with Ansys] is that we had a lot of experience dealing with particular customers, and a number of them—particularly bigger customers that we were trying to sell to—said they found it very difficult to buy anything that's not an Ansys product. The reason is that they've made the deal at the management level and Ansys has said that they can provide the company's entire simulation needs."
- "So there's a multi-million-dollar deal that's done and then that's it for every engineer working in that company—they're using Ansys or they've got to put forward a justification to say why they can't use Ansys tools to do what they need to do. That's a huge challenge when you're outside of that system to be able to sell. Because even if people really like your product, they've got to really stick their neck out to go and sell it."
- "When you're partners [with Ansys], all the barriers are removed from that perspective. We just saw from our position how effective their strategy was and how difficult it made it to work outside of that, and it's one of the reasons we went with them."
- "[Key drivers] of companies buying licenses include different projects that are launched. But then Ansys also acquires companies or works with people like us. So, as they do that, more and more products become available, so that's where the increase in revenue comes from. They start to sell more and more and the footprint increases."

> They are very effective at being able to go into an organization and say, 'We have tools that do everything you need.' ... And it's very powerful, because it means that, firstly, [a company can] work with just one provider, so all the tools talk to each other, and it means that the company that is buying all the tools can negotiate a nice deal with Ansys.
>
> *Director of an Ansys software partner*

- "There's not one [geographical] area that's growing very rapidly versus others; a while ago, we had China that was growing quite quickly, but I would say North America, China, Europe, mainland Western Europe—everything is growing and the opportunity exists everywhere. The growth rates are more related to where we put our focus, rather than anything naturally different about these different regions."

Trends in Simulation Software

- "Our tool is a multiphysics software design tool [that] does thermal, electrical, electromagnetic, and mechanical modeling. Our growth rates [in recent years] were around 35% to 40%. We had really, really strong growth in the last few years. We partnered with Ansys because we needed the worldwide sales network to be able to support the growth rates that we were experiencing."
- "It's generally understood that Ansys is one of—if not the biggest—simulation providers. They are very effective at being able to go into an organization and say, 'We have tools that do everything you need.'"
- "That's their strategy, to be able to say, 'We can provide all of your simulation needs to a company.' And it's very powerful, because it means that, firstly, [a company can] work with just one provider, so all the tools talk to each other, and it means that the company that is buying all the tools can negotiate a nice deal with Ansys, because they're transacting a lot of value and can get big discounts."

- "Ansys can go in at the high levels of an organization and sell or provide to them everything they need from a simulation perspective. Whereas, when we were working on our own as a small independent company, there was just no way we could do that; we'd just have to go one by one to every customer and sell at the level of the need where that user was. So Ansys has a very powerful position in the market because of that strategy."
- "I wouldn't say the competitors [to Ansys] try to do exactly the same. Siemens is obviously a big competitor, but Siemens comes at it from a PLM perspective. It's a slightly different approach, which is also effective, and I think Ansys is mounting some competition to that with a new tool called Minerva."
- "Dassault and Altair are also competitors, but I think Ansys is the one that has the dominant position at the moment, particularly in our industry, which is the electrification of transportation."

2) Former Ansys executive

Corporate austerity stemming from the coronavirus's impact on the economy may dent spending on Ansys for the near term. But sales will grow in coming years as companies develop increasingly complex products with more and more technological innovation. Ansys' focus on big-ticket deals with large companies promises to generate a lot of revenue. Ansys benefits from the breadth and depth of its physics, which are unmatched, as well as from a great support team and visionary leadership. Its spate of acquisitions over the past few years have left the company a bit fragmented.

Spending Drivers and Outlook

- "The focus [for Ansys] is on big deals in the tens of millions of dollars, such as one they did recently with BMW. They are trying to strike deals with mega companies. That takes market share from competitors, because companies aren't going to use two simulation providers. They have the breadth, depth, and global support structure to do it. The vice president of sales, Rick Mahoney, has put in a method to get the big deals very effectively."
- "They also are targeting startups and academe. They realize startups can become big. And they are trying to get people who don't have Ph.D.s to use their products."
- "Ansys says sales will be challenging in the near term, because companies are watching their dollars."
- "China has outspent the U.S. by $24 billion on 5G over the last five years. So, guess where Ansys is going? The trade war will hurt Ansys, but otherwise it will do well."
- "With the complexity of products and the pace of innovation, companies need simulation modeling. That technology is here to stay."

> **Ansys' strengths include the breadth and depth of its physics. That's pretty much unmatched. They have the complete solution… With the arrival of a new CEO three years ago, the leadership team is now visionary. He has encouraged big thinking.**
>
> *Former Ansys executive*

Trends in Simulation Software

- "Ansys is making its money on 5G, autonomous vehicles, electronics, and the Internet of Things. High-tech accounts for more than 30% of their revenue now."
- "Ansys' strengths include the breadth and depth of its physics. That's pretty much unmatched. They have the complete solution: electromagnetic, fluid dynamics, and structural uses. They have highly accurate results and a great support team. With the arrival of a new CEO three years ago, the leadership team is now visionary. He has encouraged big thinking."
- "Ansys' weakness is that it has growing pains. They have turned on the acquisition engines over the past three years, closing deal after deal. They are doing an OK job in trying to make it one Ansys, but there could be more effective collaboration."
- "Like many other companies, they have silos and customer solutions suffer because it. Technology and workflow gaps arise and are hard to fill because different business units have different motivations. They're compensated for the performance of their group."
- "For companies that need simulation, the cost of failure to use it in their production is too high. That makes the cost of simulation negligible."

3) Tom Avraham, co-founder of Taz-Eng and former executive for an Ansys channel partner

Ansys sales are likely to slide in Israel because the company does not take the region seriously, offering little marketing or support. Ansys is content to serve the foreign offices of large companies like HP Inc. (HPQ) and Applied Materials Inc. (AMAT) and the few large Israeli companies, like Rafael Advanced Defense Systems Ltd. It is not making an effort to attract small and medium companies—the heart of Israel's economy.

Spending Drivers and Outlook

- "You can buy two [Ansys] licenses for a substantial discount, but even that hasn't sold much in Israel. We sold maybe three a year [as a channel partner]."
- "In the last five years, customer spending [on Ansys products in Israel] may have increased, but not by much. And that's largely paying for upgrades. It's hard to sell without marketing and support."
- "Ansys should start its marketing at academe. If you start with [Siemens'] Star-CCM at school, you're going to go to this tool later on. Ansys hasn't done anything to penetrate academe. Even if a school bought it, there wasn't guidance."
- "Customer spending will probably decrease in the next few years. Israel is a small country that Ansys doesn't take seriously. It needs to push support. Customers need to be connected to the company. There should be policies for how to support clients. That's non-existent in Israel."

Trends in Simulation Software

- "Israel has no auto industry or aerospace. It's a startup nation, so its main motor is software. Ansys is used by big companies—defense companies like Rafael and foreign companies, such as HP and Applied Materials, that have global licenses, but get their support in the U.S."
- "Ansys' main advantage is its big scale of engineers working and coding together."
- "Its weakness is that it has a hard time reaching small and medium companies, which account for much of Israel's economy. Large customers know what they need. Ansys has almost no marketing in Israel."
- "It's hard to sell a $50,000 to $100,000 license to a small company. You need training, marketing, and support. But Ansys doesn't have that in Israel."

> **Ansys' main advantage is its big scale of engineers working and coding together.**
>
> *Tom Avraham, co-founder of Taz-Eng and former executive for an Ansys channel partner*

Secondary Sources

These two secondary sources focused on the concept of digital twins and Ansys' role in the technology. Digital twins allow companies to test and monitor expensive industrial equipment virtually. Microsoft Corp. (MSFT), Ansys, and others are among a group working on standards for the emerging technology.

June 4 Motley Fool article

Microsoft and Ansys have teamed up to help equipment operators predict maintenance needs based on real-time data and operating conditions, a technology known as digital twinning. Gartner has identified digital twinning as one of its top 10 strategic technology trends.

- "Not long ago, it seemed too futuristic to calculate life spans of industrial equipment under a variety of scenarios in real time. Today, it's not only possible, but it's also changing the way manufacturing works. By integrating cloud capabilities with the industrial Internet of Things (IoT), digital twinning can be achieved, allowing experimentation with variables in real time to predict outcomes."
- "Two powerhouses in their respective fields have linked up to help manufacturing become faster and more cost-efficient. Microsoft's (NASDAQ:MSFT) Azure Internet of Things (IoT) cloud system is connecting production lines to engineering teams. ANSYS (NASDAQ:ANSS), is making that data dynamic and available for manipulation. The resultant digital twin creation of objects or environments are used to try out virtual working alterations in real time."
- "For the third year in a row, Gartner (NYSE:IT), a research and advisory firm, has identified digital twinning as one of the top 10 strategic technology trends. According to Gartner, 13% of organizations that are implementing IoT have

already adopted digital twins, and 62% are in the process or plan to do so. Gartner predicts a tipping point in 2022 when two out of three companies will have deployed at least one digital twin to optimize some facet of their business processes."

- "In manufacturing, digital twins can help equipment operators anticipate breakdowns, refining maintenance timing and reducing unexpected maintenance shutdowns, thereby dramatically lowering costs. The process is a simulation that allows engineers and designers to create virtual replicas of physical systems and devices, then introduce variables such as temperature, speed, and pressure. Digital twinning is different from creating a computer aided design (CAD) model in two ways: its real time connectivity and its variance, or ability to dynamically change the object's design and operating conditions."
- "The partnership between Microsoft and ANSYS integrates complementary systems for creating digital twinning. ANSYS leverages its proprietary Twin Builder solution across Microsoft's Azure IoT services to provide customers the most advanced simulation potential with the smoothest cloud interconnectivity."
- "Unlike more traditional virtual designs, like those from CAD, digital twins can be tested alongside the physical systems they're mirroring, and they allow engineers to perform predictive maintenance and test for faults before they have a chance to arise."
- "A MarketsandMarkets report updated in January estimates that the digital twinning market had a value of $3.8 billion in 2019, and will reach $35.8 billion by 2025, at a compound annual growth rate (CAGR) of 45.4%."

May 21 Engineering.com article

Ansys is among the founding members and governing board for the Digital Twin Consortium, aimed at promoting and developing standards for digital twin technology.

- "'A digital twin technology explosion is about to occur,' says the Digital Twin Consortium, a newly formed open membership organization that intends to tame the often-muddy concept of digital twins."
- "Ansys, Dell Technologies, Lendlease, and Microsoft are all on board as founding members of the Digital Twin Consortium, bringing some serious industrial clout to the new organization. The initiative is spearheaded by the Object Management Group (OMG), also behind other consortiums including the Industrial Internet Consortium and Consortium for Information & Software Quality."
- "What is a digital twin? In the succinct words of the Digital Twin Consortium, digital twins are 'virtual models of a process, product or service that allow for data analysis and system monitoring via simulations.'"
- "Software companies have been pushing for digital twins for years, promising users the moon (and its twin) if only they would come on board. But many remain unclear on the specifics."
- "'Most definitions of digital twin are complicated, but it's not a complicated idea,' said Richard Soley, Executive Director of the Digital Twin Consortium. 'What makes a digital twin difficult is a lack of understanding and standardization.'"
- "The Digital Twin Consortium aims to clear up confusion about digital twins by implementing industry standards—but not directly. The Consortium will develop industry guidelines and best practices and submit their recommendations to international standards development organizations like OMG, ISO, and IEC."
- "Founding members Ansys, Dell, Lendlease, and Microsoft will govern the Consortium, organizing working groups of member representatives."
- "Of the founders, Ansys has been the most vocal about digital twins, launching a product called ANSYS Twin Builder back in 2018. Microsoft has also pushed for digital twins on its Azure IoT platform, and teamed up with Ansys for a digital twin collaboration last year. Dell Technologies is an active player on the IoT side of things, providing hardware for edge computing. The fourth founder, Lendlease, is an interesting wildcard—neither a software nor a hardware company, Lendlease is a property developer that's pursuing digital twins in construction."
- "Other early members of the Digital Twin Consortium include Air Force Research Lab (US), Bentley Systems, Executive Development, Gafcon, Geminus.AI, Idun Real Estate Solutions AB, imec, IOTA Foundation, IoTIFY, Luno UAB, New South Wales Government, Ricardo, Willow Technology, and WSC Technology."

Additional research by Eva Cahen, Emily Carr, and Dan Weil.

purpose of the research. To the best of our knowledge and efforts, Blueshift confirmed that the underlying source(s) lawfully obtained the information shared with Blueshift and were entitled to provide such information to Blueshift without breaching a duty to another party. The data in this report has undergone review from Blueshift Research's Compliance Officer and has been approved for distribution to Blueshift Research's clients.