Research Insights Paper

Three Transformational Compute Technologies Verified to Accelerate AI and Business Value

The Business Benefits of Leveraging Advanced Compute Infrastructure for AI Initiatives

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Can the Right Infrastructure for Artificial Intelligence Improve Business Outcomes?

The field of analytics has long empowered businesses to extract value from their data. Given the competitive demands of the modern digital economy, however, businesses want and need to do more. Fueled by a desire for greater accuracy along with faster, more predictive, and more granular insights, businesses are turning to the rapidly progressing field of artificial intelligence (AI).

The concept of AI has existed for decades. But now, machine learning (ML), and a subset of ML called deep learning (DL), makes it possible to train AI software faster and help it to deliver far greater accuracy. ML algorithms learn from the data, which empowers the software to make predictions and act on them. These algorithms are now even improving over time, based on the data they collect.

The availability of relatively low-cost compute, the abundance of seemingly unlimited data, and new breakthroughs in AI models and algorithms mean that the possibilities for AI initiatives are now practically endless. Today, AI is automating decision making, improving customer interactions, streamlining operations, and helping companies to take advantage of new product and market opportunities.

Data offers one of the greatest-ever chances for businesses to achieve a competitive advantage.

Through AI, data offers one of the greatest-ever chances for businesses to attain a competitive advantage. Even with all this excitement, questions remain:

- What business benefits are realistic with AI initiatives?
- What technologies, if any, foster better results?

ESG recently conducted a detailed study to answer those questions and better understand and quantify the relationships between modern compute technologies, the use of AI-based workloads, and resulting business outcomes. From this research, ESG identified that:

- AI presents a tremendous opportunity to extract and capture value trapped in data.
- By using AI effectively, firms are becoming stronger, more successful, and more competitive.
- Some compute technologies are far better positioned than others to support corporate AI initiatives.

Identifying the Kind of Infrastructure that Drives AI Success

This data-validated paper describes the results that businesses are achieving by deploying AI on modern compute infrastructure. The survey behind the research reflects responses from 750 global respondents—all of them IT professionals employed at organizations using AI today or planning to deploy AI in the next 24 months. All the respondents had to be familiar with the IT infrastructure underpinning their AI workloads, as well as the business initiatives and processes that AI is (or will be) augmenting.[1]

[1] For details on the specifics of the study, as well as the methodology used to define and create the maturity stage of each respondent organization, please refer to the appendices at the end of this document.

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Establishing Compute Optimized for AI Maturity Stages

ESG asked study participants a series of questions about the compute infrastructures they have in place to support their organizations' AI workload development and use. ESG then assigned points (a maximum of 30 possible) based on their responses. Using the point totals, ESG assigned each organization to a "compute optimized for AI" maturity stage. Each organization's maturity stage reflects its use of three modern compute technologies that influence and improve AI workload support:

1. Modern servers with **extensive automation capabilities** in use (i.e., automated updating, monitoring, configuring, provisioning, and issue remediation).
2. The use and extent of **accelerators** such as graphics processing units (GPUs) or field-programmable gate arrays (FPGAs) to support AI workloads.
3. The use of **converged/hyperconverged infrastructure** to support AI workloads.

ESG then assigned each organization to one of three maturity levels:

- **Stage 1 (42% of organizations in the study):** Low levels of automation, very limited use of accelerators, and/or little to no converged/HCI-based infrastructure for AI.
- **Stage 2 (33% of organizations):** Moderate levels of automation, some use of accelerators, and/or some converged/HCI-based infrastructure for AI.
- **Stage 3 (24% of organizations):** High levels of automation, broad use of accelerators, and/or high use of converged/HCI-based infrastructure for AI.

The Impact of Compute Optimized for AI Maturity: A Summary of Research Findings

Higher maturity levels in terms of using server automation, accelerators, and converged/HCI greatly improve an organization's ability to develop and use AI workloads in production. Achieving a higher level of maturity with these three modern compute technologies also fuels superior business outcomes.

This study found multiple impacts of greater **compute optimized for AI maturity**, including:

- **Faster and superior AI model development.** For example, *Stage 3* organizations are 7X more likely than *Stage 1* to say they lead competitors in their ability to develop, deploy, and tune AI models in production.
- **Broader and richer adoption and use of AI workloads in production.** For example, *Stage 3* organizations are 4.5X more likely than *Stage 1* to say they have AI deployed extensively in production.
- **Superior business outcomes and a stronger, more competitive business**: For example, *Stage 3* organizations are 7.8X more likely than *Stage 1* to say AI has been very effective at driving value. *Stage 3* organizations are also 2X more likely than *Stage 1* to experience a time to value for AI that was shorter than expected.

The remainder of this paper provides details about the positive business outcomes achieved by *Stage 3* organizations that use modern compute optimized for an AI infrastructure.

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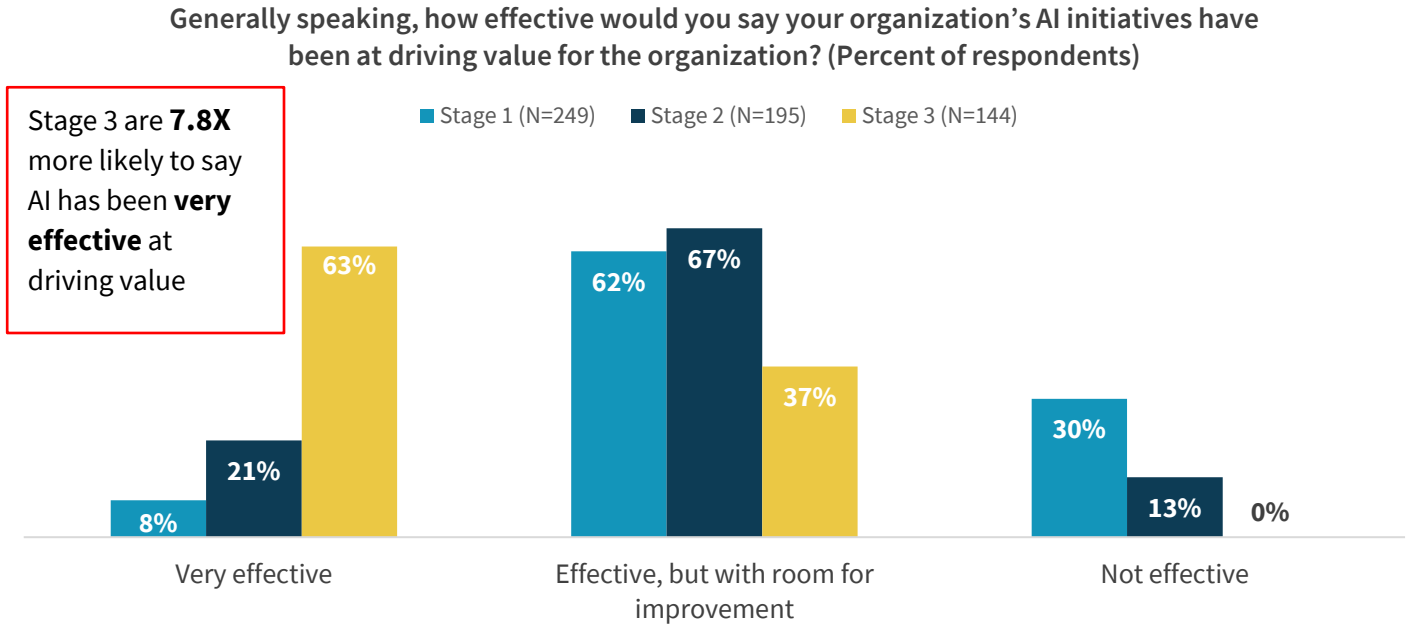
Compute Optimized for AI Maturity Fuels AI and Delivers Superior Business Outcomes

AI initiatives are typically founded with a desire to capture an edge over the competition. To this end, firms often invest heavily in finding the right personnel, equipping them with the right software apps and tool sets, and supporting them with the right infrastructure. Does the compute infrastructure matter, though? Can selecting the right technologies change how effective AI projects are at delivering business outcomes? The answer to both these questions is an emphatic, "Yes."

ESG asked study participants to respond on the state and relative success of their AI initiatives, the value captured from those initiatives, and their firm's competitive strength. The findings reveal that *Stage 3* organizations enjoy a significant advantage over their less mature counterparts in multiple business areas.

Starting with the connection between AI initiatives and overall business value, *Stage 3* organizations were highly likely (63%) to identify as very effective at driving value from AI initiatives. This percentage is nearly 8X that of *Stage 1* organizations and 3X that of *Stage 2* organizations.

Figure 1. Compute Optimized for AI Maturity Delivers Greater Value from AI Initiatives



Source: Enterprise Strategy Group

Not only do *Stage 3* organizations enjoy a higher likelihood of unlocking greater value, these firms that leverage modern compute technologies are also better equipped to expedite the delivery and deployment of AI workloads in production (Figure 2). *Stage 3* organizations are nearly just as likely to exceed time-to-value expectations as not to, and they are 2x more likely to achieve a shorter time to value relative to expectations than the less mature *Stage 1* organizations.

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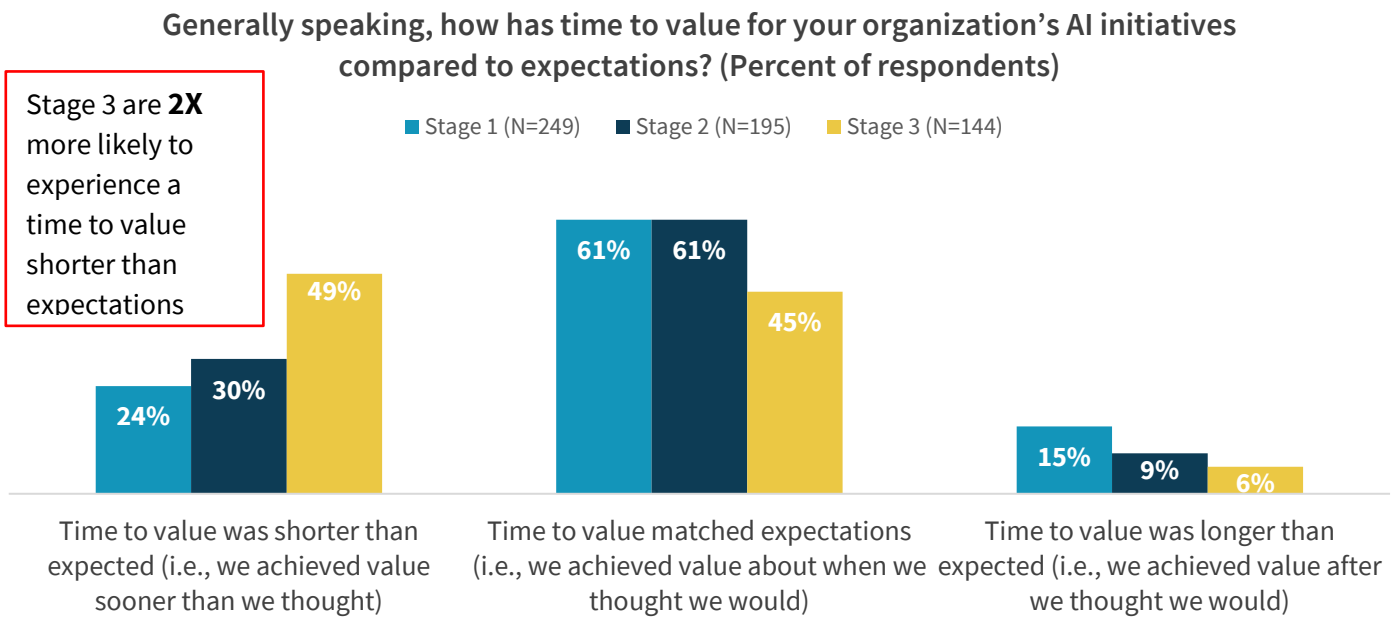
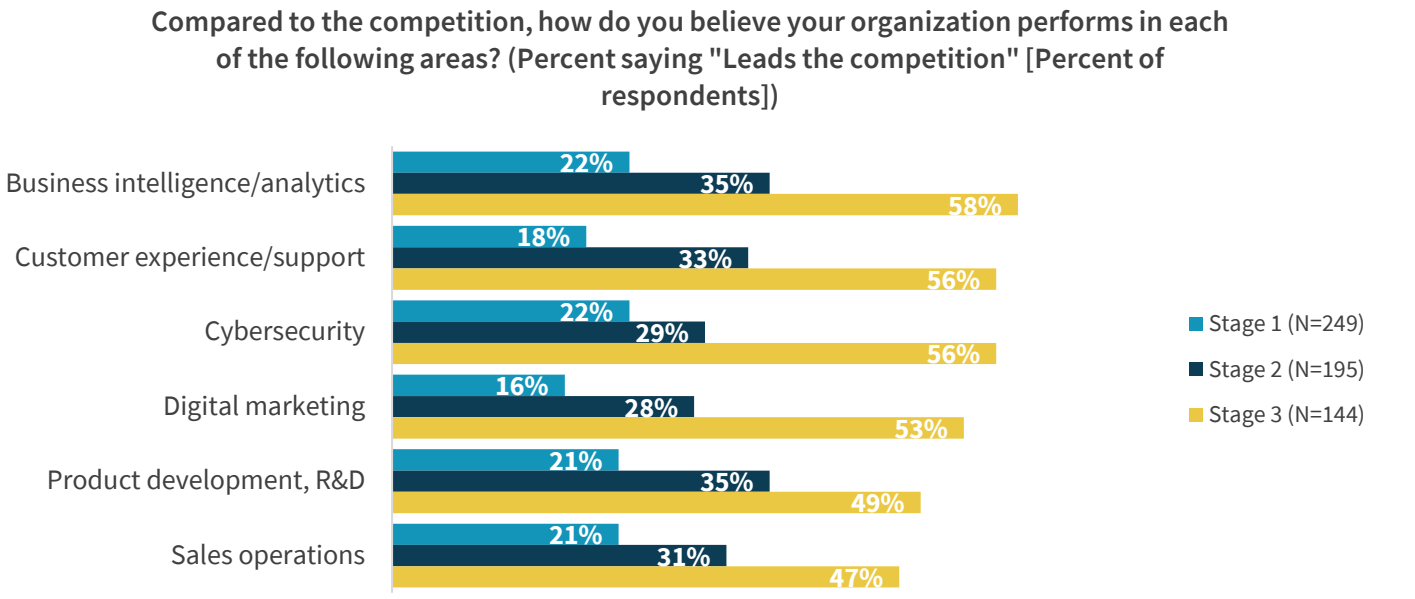
Figure 2. AI-enabling Compute Accelerates Time to Value for AI Initiatives



Source: Enterprise Strategy Group

With improvements in both the value captured and time to value, *Stage 3* organizations are far more likely to achieve an AI leadership position in their industry not just in one area, but across a wide variety of business segments (Figure 3). *Stage 3* organizations reported their likelihood of leading the competition as ranging from just under 50% to close to 60% across multiple diverse business segments. These segments range from business intelligence to customer experience to operational benefits, such as leading in security, marketing, development, and sales. The data presents a correlation between leveraging compute optimized for AI technologies and a greater likelihood of being a perceived leader in nearly every business facet.

Figure 3. Compute Optimized for AI Maturity Empowers Multiple Segments of the Business



Source: Enterprise Strategy Group

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While causation is often difficult to prove, the extent that *Stage 3* organizations exceed their less mature counterparts across multiple diverse categories of business success suggests that this correlation is more than coincidence. The three modern compute technologies that make up the focus of this study likely offer tangible benefits. In other words, for organizations to have the best opportunity to maximize the benefits from AI initiatives, the use of modern compute infrastructure not only matters; it is essential.

Stage 3 companies, with their more extensive use of server automation, accelerators, and converged/hyperconverged infrastructure for AI exceed their counterparts across nearly every facet of the business. In summary:

- *Stage 3* organizations are **2.6X more likely** than *Stage 1* **to lead the competition in business intelligence and analytics**.
- *Stage 3* organizations are **3.1X more likely** than *Stage 1* **to lead the competition in customer experience and support**.
- *Stage 3* organizations are **2.5X more likely** than *Stage 1* **to lead the competition in cybersecurity**.
- *Stage 3* organizations are **3.3X more likely** than *Stage 1* **to lead the competition in digital marketing**.
- *Stage 3* organizations are **2.3X more likely** than *Stage 1* **to lead the competition in product development**.
- *Stage 3* organizations are **2.2X more likely** than *Stage 1* **to lead the competition in sales operations**.
- *Stage 3* organizations are **7.8X more likely** than *Stage 1* **to say AI has been very effective at driving value.**
- *Stage 3* organizations are **2X more likely** than *Stage 1* **to experience a time to value for AI shorter than expectations.**

Quantifying the Business Outcomes and Benefits Achieved by Leveraging Compute Optimized for AI

Utilizing the right compute infrastructure, one that is optimized for AI, improves the likelihood of benefiting from AI initiatives. It also improves the time to value for AI projects. It even increases the chances of leading the competition across a broad range of business segments. But, what about the value of the benefits achieved from those projects? Yes, *Stage 3* organizations are better at executing AI projects. Once in place, however, are the rewards greater for *Stage 3* organizations than others with less mature compute infrastructure? Again, the answer is "Yes."

The data in Figure 4 shows the average percentage improvement across a variety of metrics, covering customer success, operations efficiency, and reduced downtime cost and risk. **The rewards captured by *Stage 3* firms ranged from nearly a 2X to an over 3X improvement over that of *Stage 1* organizations** depending on the specific metric, as shown in Figure 4.

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Figure 4. Greater Compute Optimized for AI Maturity Improves Value Realized from AI

	Stage 1	Stage 2	Stage 3
Average improvement in customer spend	6%	8%	**18%**
Average improvement in customer retention	8%	9%	**19%**
Average improvement in decision speed	9%	12%	**19%**
Average improvement in quality assurance	9%	14%	**17%**
Average improvement in decision accuracy	8%	10%	**21%**
Average reduction in IT downtime	6%	13%	**19%**
Average cost reduction through automation of business processes and/or operations	6%	10%	**16%**
Average reduction in business risk	8%	12%	**21%**

When reviewing these results, it is essential to consider the aggregate of the data shown in Figures 1 - 3. Not only are the rewards greater for *Stage 3* organizations, but the rewards are also more likely, achieved more quickly, and applied across a broader range of business segments. As a result, the realized value of leveraging the right modern compute infrastructure is far greater than any one of these individual figures might suggest on their own.

Revenue Impact Achieved with Greater Compute Optimized for AI Maturity

What about the financial impact? Do the benefits from utilizing the more modern compute technologies show up on the corporate financials, or are the benefits derived from more effective AI development and its broader use in production overshadowed by other market forces? The data in Figure 5 and Figure 6 reveal that *Stage 3* businesses achieve superior revenue uplift from AI than their competition. More than half (58%) of *Stage 3* organizations achieve more than 10% of their revenue from projects that stem from an AI initiative, which is 2X the number of *Stage 1* organizations that report the same increase.

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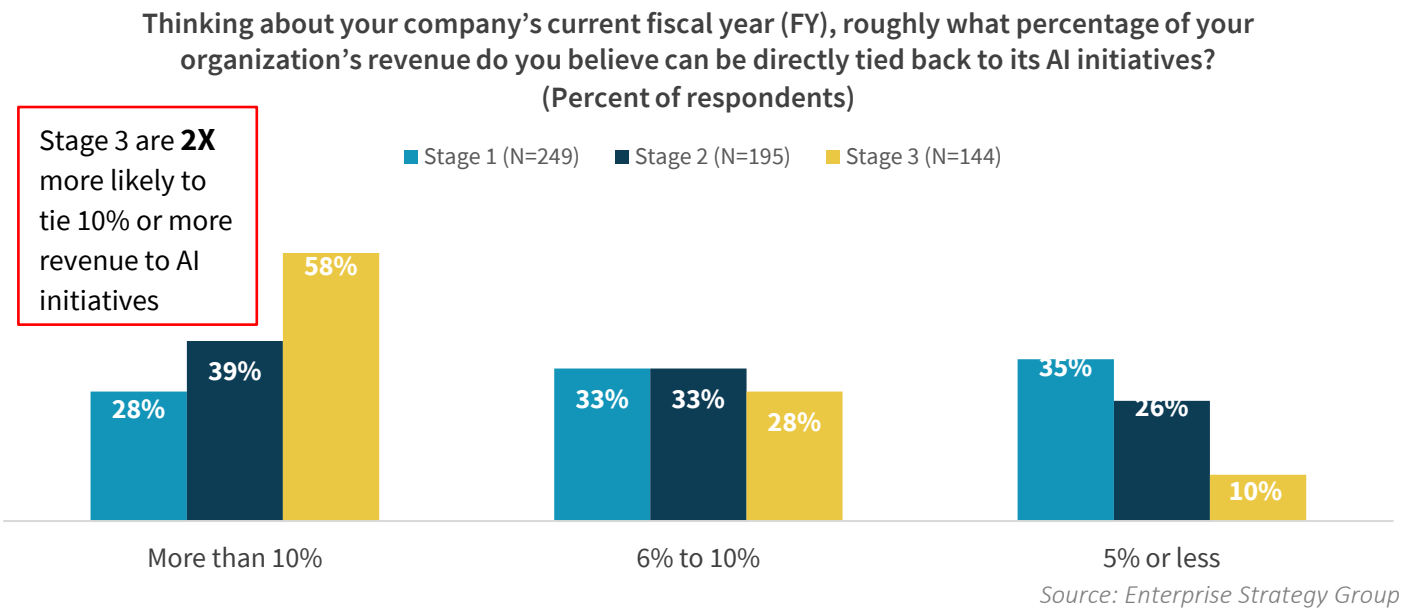
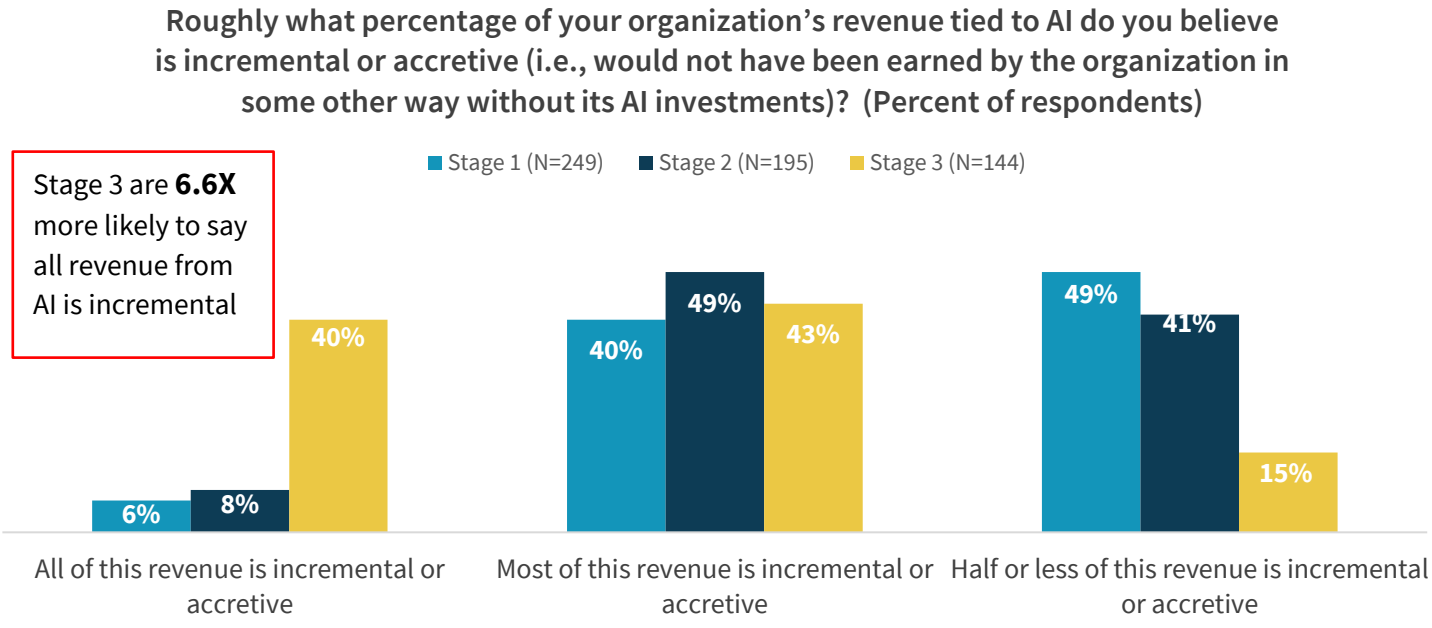
Figure 5. Compute Optimized for AI Maturity Improves Revenue Impact of AI Initiatives



Source: Enterprise Strategy Group

While percentage of revenue associated with AI is important, the data in Figure 6 may be more significant. *Stage 3* organizations significantly outpaced their less mature counterparts in delivering incremental revenue with AI. *Stage 3* organizations were 6.6X more likely than *Stage 1* organizations and 5X more likely than *Stage 2* organizations to respond that all the revenue tied to their AI initiatives is incremental.

Figure 6. Compute Optimized for AI Maturity Delivers Incremental Revenue Impact of AI Initiatives



Source: Enterprise Strategy Group

In nearly every way, leveraging an optimized compute environment delivers a superior foundation for AI development, which in turn leads to faster, richer, and broader adoption of AI workloads and use cases.

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Understanding How Compute Optimized for AI Fuels Superior AI Development and Usage

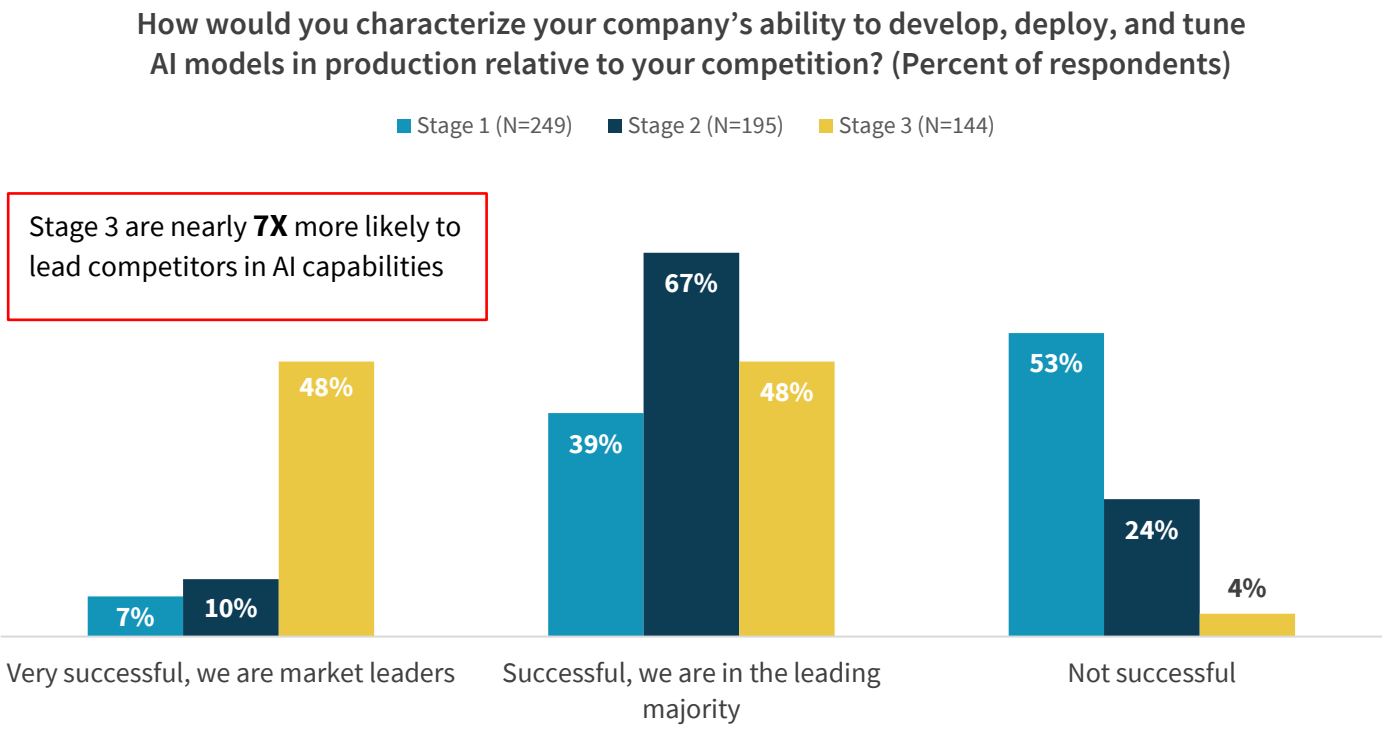
The previous section focused on the value and business benefits achieved by *Stage 3* organization due to the greater and more extensive use of the three modern, transformational compute technologies (server automation, accelerators, and converged/hyperconverged infrastructure). This section provides background on how these three technologies empower firms to achieved greater business outcomes.

Compute Optimized for AI Maturity Fuels Superior AI Workload and Model Development

Effective use of AI begins with the organization's ability to develop models and then deploy those models in production, as well as the ability to train and improve those models over time. In this study, ESG identified a strong link between leveraging the three modern compute technologies that define compute optimized for AI maturity and a tangible, significant improvement in both the development of AI models and the use of those models in production workloads.

The data presented in Figure 7 highlights the significant advantage enjoyed by *Stage 3* organizations, those that were mature in their use of these three compute technologies. Specifically, nearly half (48%) of the *Stage 3* organizations identified themselves as leaders in their respective markets in AI model development, deployment, and tuning. When compared to their *less mature* counterparts, the *Stage 3* organizations were nearly 7X more likely than *Stage 1* organizations and nearly 5X more likely than *Stage 3* organizations to consider themselves to be a market leader in AI model development.

Figure 7. Compute Optimized for AI Helps Organizations Lead Competitors in AI Achievement



Source: Enterprise Strategy Group

Looking forward, *Stage 3* organizations were also more likely to expect continued success with AI, with 60% very confident in their IT organizations to satisfy future AI goals over the next 36 months. This percentage was 6X that of Stage 1 organizations (60% versus 10%).

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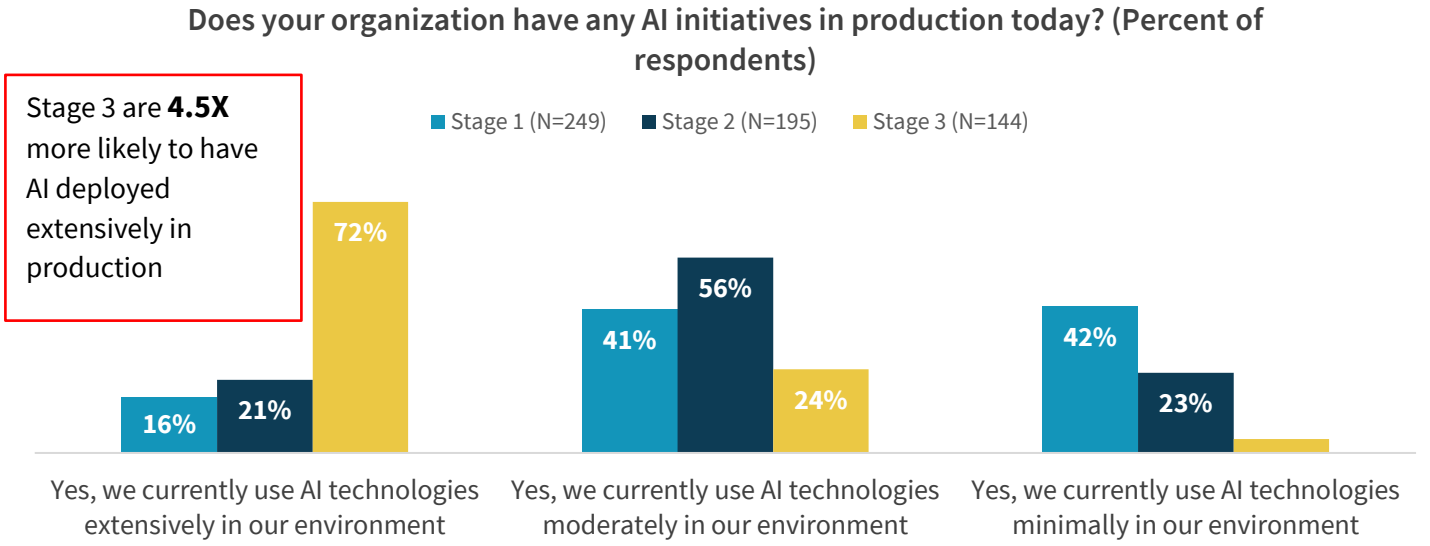
Superior AI Development with Compute Optimized for AI Fuels Broader Use of AI in Production

As one might expect, perceived leadership in AI model development, deployment, and tuning increase the extent that AI-based workloads are utilized in production. The data in Figure 8 shows that nearly three quarters (72%) of *Stage 3* organizations responded that they use AI technologies extensively across their environment, which was 4.5X greater than *Stage 1* and 3.4X greater than *Stage 2* organizations.

Figure 8. Compute Optimized for AI Improves Likelihood of AI in Production



Source: Enterprise Strategy Group

This data suggests that the deployment and use of AI models or workloads is not a "one and done" process. AI technologies and use cases can be implemented across multiple facets of the business. Leveraging compute technologies optimized for AI not only increases the likelihood of more extensive use of AI in production, but it also increases the breadth of different types of AI workloads the organization is able to support.

For visibility on how this increased breadth is realized, Figure 9 presents data on the usage rates of a variety of popular AI initiative types. ESG found the *Stage 3* organizations range from 21% to 2X more likely to have specific models in production, indicating a massive advantage in the breadth of AI use in production.

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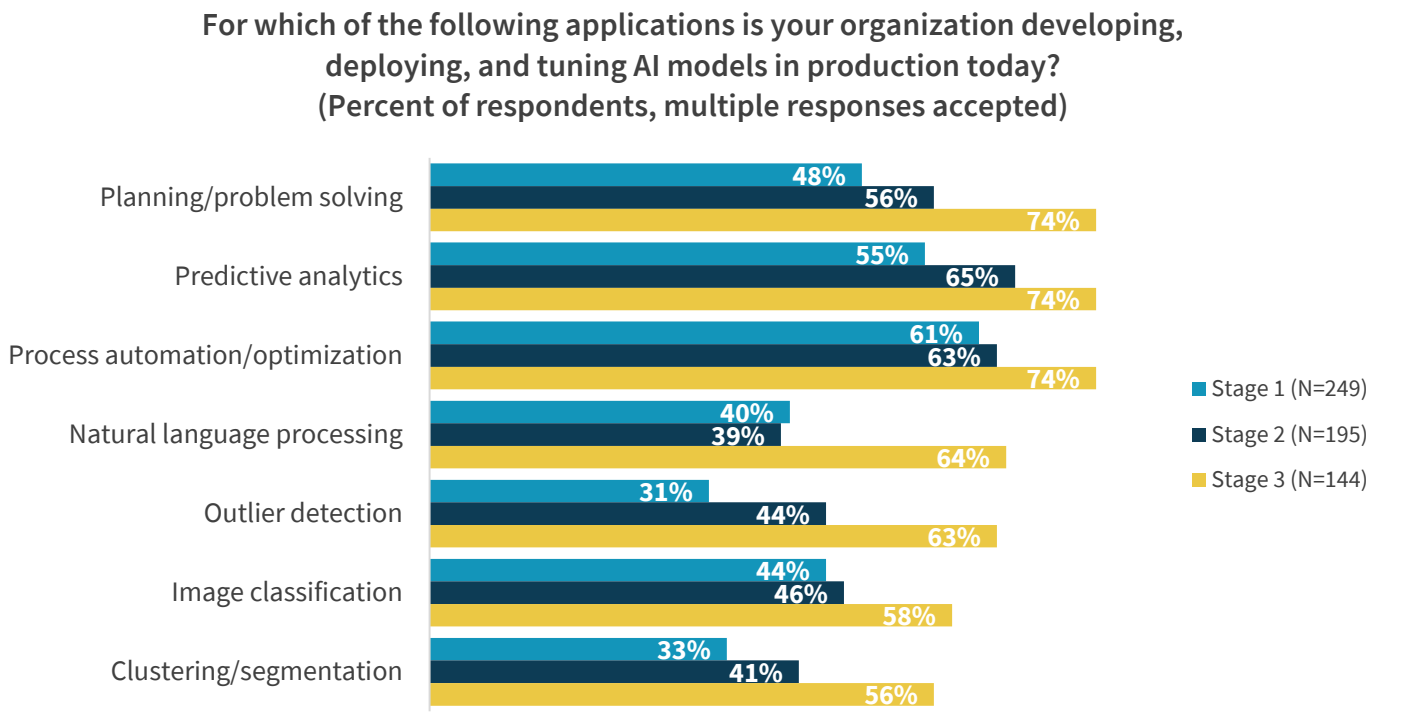
Figure 9. Compute Optimized for AI Increases Breadth of AI Models in Production



Source: Enterprise Strategy Group

In other words, *Stage 3* organizations not only achieved improved AI development, and a broader use of AI in production, but those firms with mature use of modern compute also indicated that the greater breadth of models used in production helped to support multiple business facets.

In summary, the following three modern, transformational compute technologies were used to define the compute optimized for AI maturity levels:

1. The use of modern servers with **extensive automation capabilities** for updates, monitoring, configuration, provisioning, and issue remediation.
2. The use of **accelerators, like GPUs or FPGAs**, to support AI workloads.
3. The use of **converged/hyperconverged infrastructure** to support AI workloads.

Organizations that are mature in their use of those three technologies were found to realize the following benefits:

- They enjoy superior AI model development.
- This superior model development enables a broader and more diverse use of AI models in production.
- This broader use of AI in production improves the value created from AI initiatives, the breadth of business areas where value is captured, and the time to value achieved.

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The combined impact improves the revenue percentage delivered by AI projects as well as the likelihood that the revenue will be incremental. When combined, the data from the study presents a clear path to success. AI initiatives should always start with defining the use case—the problem the business wishes to solve. Once that is understood, the data and performance requirements will dictate the high-level infrastructure requirements. When meeting those requirements, however, multiple infrastructure options exist. This research highlights three compute technologies that can significantly improve the chances of success with AI initiatives. As a result, increasing the usage of modern servers with **extensive automation capabilities, accelerators, and converged/hyperconverged infrastructure** should be part of any infrastructure design process for AI.

The Bigger Truth

Data is a powerful asset, one that can put meaningful distance between you and the competition. Data has always had value, of course. But the recent dramatic progress in AI-based machine learning and deep learning are showing just how tremendous the promise now is in terms of unlocking data's maximum value.

ESG's findings show that the intelligence promised by AI is absolutely real. The business-level value is real. And it appears equally true that AI-related success centers on not only having a clear definition of the problem to be solved and the right people involved, but also on having the right infrastructure in place. Firms that are mature in their use of server automation, application accelerators, and converged/HCI are achieving much more success with AI than firms attempting to make do with a less capable infrastructure.

Given the high priority and visibility associated with AI initiatives, plus the massive investments in personnel, businesses should be doing everything in their power to enable these initiatives to succeed. The three technologies identified in this study should not only improve the odds of success—in many cases, they should *dramatically* improve those odds.

And notably, the three technologies also offer a kind of "starting guide" to overall compute infrastructure investment. Essentially, AI promises to result in a better and more competitive business. But when that AI is coupled with the right compute technology, the benefits may be even greater.

In other words, infrastructure matters … especially with AI.

How Dell EMC and Intel Technologies Can Help

This ESG Research Insights Paper was commissioned by Dell EMC and Intel Corporation. To learn more about Dell EMC and how its family of brands can help you make the most of your AI vision, start here:

- The optimized-for-AI PowerEdge Servers offer best-in-class automation, modular agility, and compatibility with multiple hardware acceleration options. PowerEdge offers support for GPUs and/or FPGAs to accelerate training. Additionally, by leveraging an Intel Xeon-based infrastructure, PowerEdge can offer inference performance improvements for AI workloads, as much of inference is done on the CPU. Intel claims the 2nd Gen Intel Xeon Scalable processors are the only data center CPUs with AI acceleration built in.

- A global network of 21 dedicated Dell Technologies Customer Solution Centers have world-class IT experts to collaborate with you, help reduce the risks associated with new technology investments, and help improve speed and ease of implementation.

    - Dell EMC's worldwide HPC and AI Centers of Excellence provide thought leadership, test new technologies, and share best practices. They provide a network of resources based on the wide-ranging know-how and experience in the community.

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  - Access the Dell EMC HPC and AI Innovation Lab, a 13,000-square-foot data center with thousands of Dell EMC servers, two powerful supercomputers, and sophisticated storage and network systems. It's staffed by a dedicated group of computer scientists, engineers, and Ph.D. subject matter experts who can work with you.

- Dell Technologies Consulting helps organizations of all sizes, industries, and maturity levels adopt and accelerate their analytics and AI capabilities from strategy through to execution and data modeling. Services for AI include ProConsult Advisory Services, comprising facilitated development of a plan to modernize your analytical platforms and architectures for scalability and performance that use AS-IS / TO-BE methodology. The services provide an unbiased, end-to-end assessment that delivers actionable outcomes aligned to your corporate vision and strategy.

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Appendix I – Research Methodology and Respondent Demographics

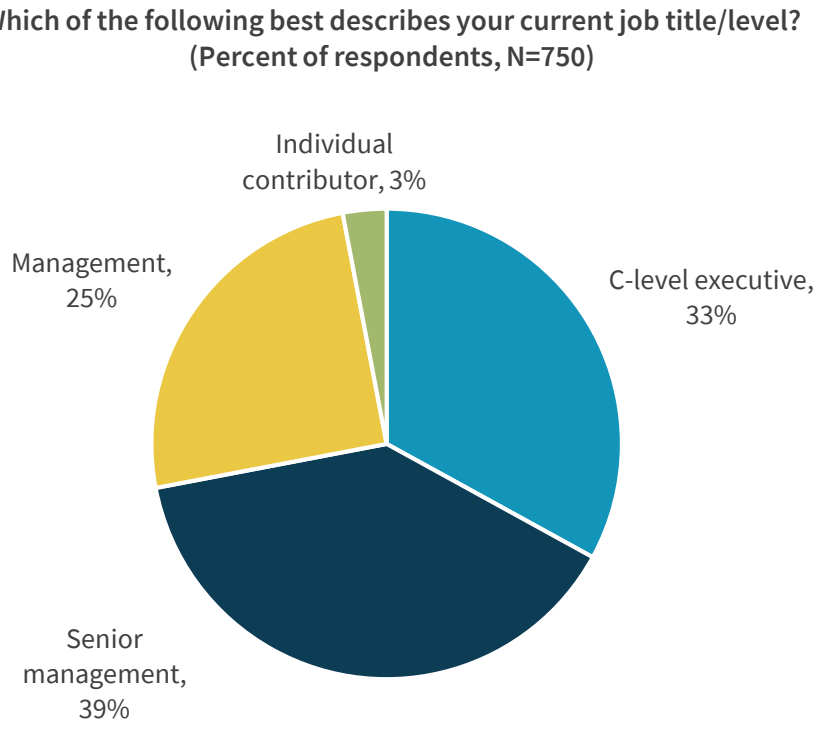
To gather data for this report, ESG conducted a comprehensive online survey of IT decision makers from private- and public-sector organizations in 9 countries: U.S. (32%), Canada (7%), U.K. (9%), France (11%), Australia (8%), New Zealand (3%), Singapore (9%), China (11%), and Brazil (11%). The survey was fielded between May 7, 2019 and May 30, 2019. To qualify for this survey, respondents were required to have influence in the purchase process for data center infrastructure, private cloud investments, data protection, or AI/ML technologies. Furthermore, all were required to be knowledgeable about their organization's current/planned AI initiatives.

After filtering out unqualified respondents, removing duplicate responses, and screening the remaining completed responses (on several criteria) for data integrity, a final sample of 750 respondents remained.

All respondents were provided an incentive to complete the survey in the form of cash awards and/or cash equivalents. Note: Totals in figures and tables throughout this report may not add up to 100% due to rounding.

The following figures detail the demographics of the respondent base: individual respondents' current job responsibilities, as well as respondent organizations' total number of employees, primary industry, and annual revenue.

Figure 10. Survey Respondents, by Job Responsibility



Source: Enterprise Strategy Group

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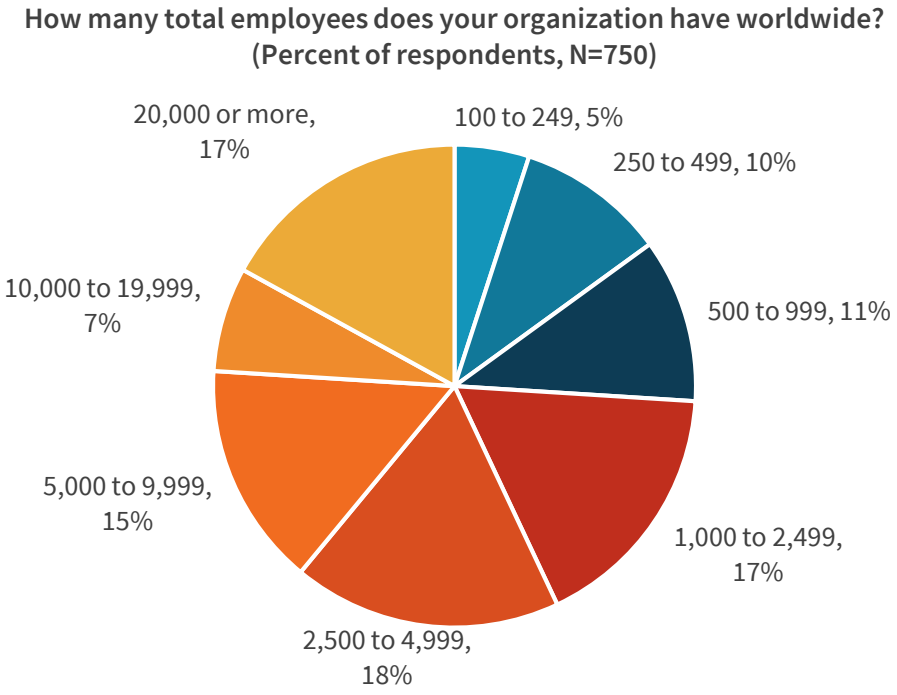
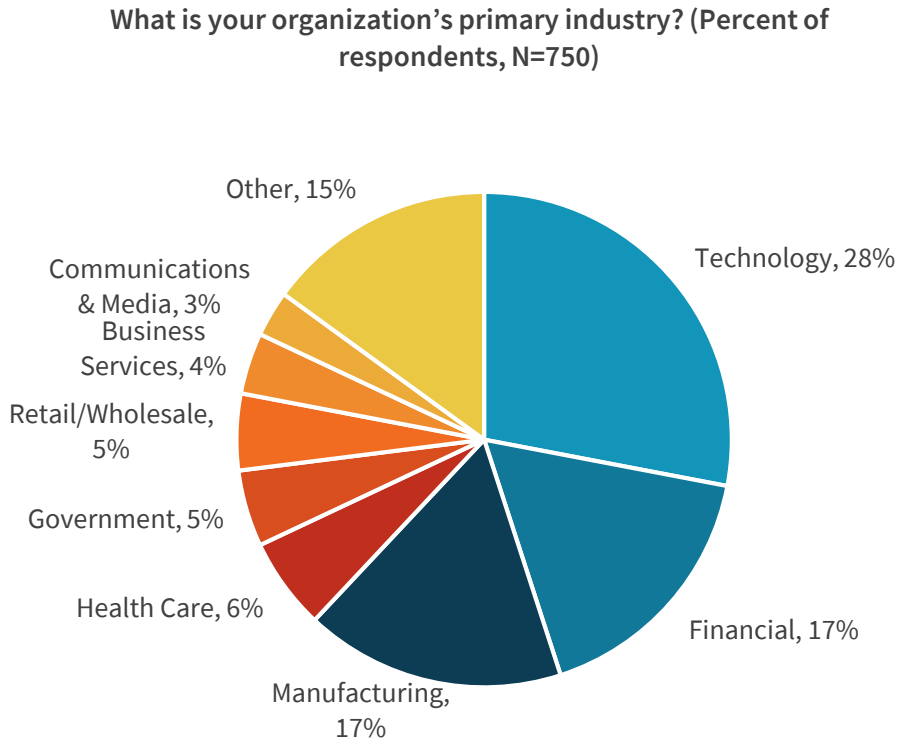
Figure 11. Survey Respondents, by Company Size (Number of Employees)



Source: Enterprise Strategy Group

Figure 12. Survey Respondents, by Industry



Source: Enterprise Strategy Group

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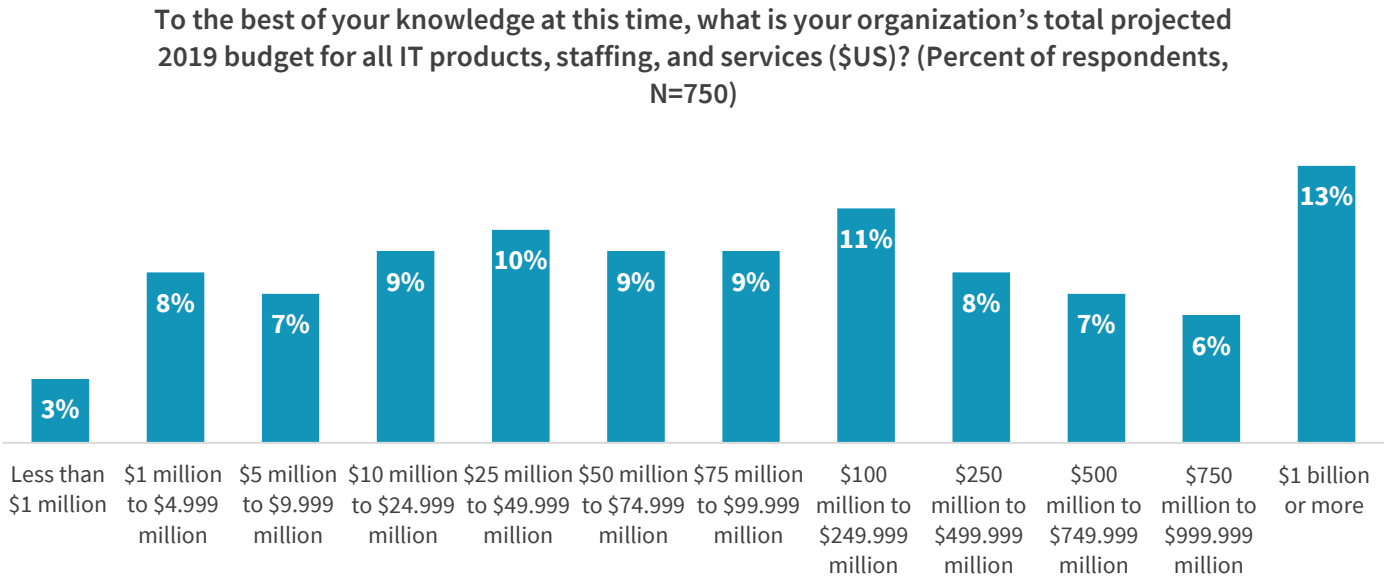
Figure 13. Survey Respondents, by IT Budget



Source: Enterprise Strategy Group

Appendix II – Criteria for Evaluating Organizations' Maturity Leveraging Compute Optimized for AI

This section will present further details on how the maturity levels were established. As mentioned previously, participants in the study were assigned points based on their usage of three modern compute-centric technologies that enable AI workload development and use, with a maximum of 30 points possible.

Based on those points, each respondent organization was assigned to a maturity stage based on their use of three technologies, which influence and improve the support of AI workloads:

1. Server Automation: Points ranging from 0 to 10 were awarded based on the extent of server automation in use in three different categories: server updates and monitoring, server configuration/provisioning, and issue diagnosis and remediation. Participants that identified as being entirely or mostly automated for all three tasks were awarded 10 points. Those identified as being entirely or mostly automated for two of the three tasks were awarded 7.5 points, and 2.5 points for just one task. All others received zero points. In this regard, the value was achieved by not only being high automated, but also automating a greater variety of server-related tasks.

2. Accelerated Compute: Points ranging from 0 to 10 were awarded based on the use and extent of accelerators, like GPUs or FPGAs, to support AI workloads. Organizations that identified as using these technologies extensively received 10 points. Those that said the technologies were in use received 7.5 points while other organizations received reduced point values.

3. Use of Converged/Hyperconverged: Points ranging from 0 to 10 were awarded based on the use of converged/hyperconverged infrastructure to support AI workloads. Organizations that identified as using hyperconverged or both converged and hyperconverged received 10 points. Those that identified as only using converged received 5 points while other organizations received 0 points.

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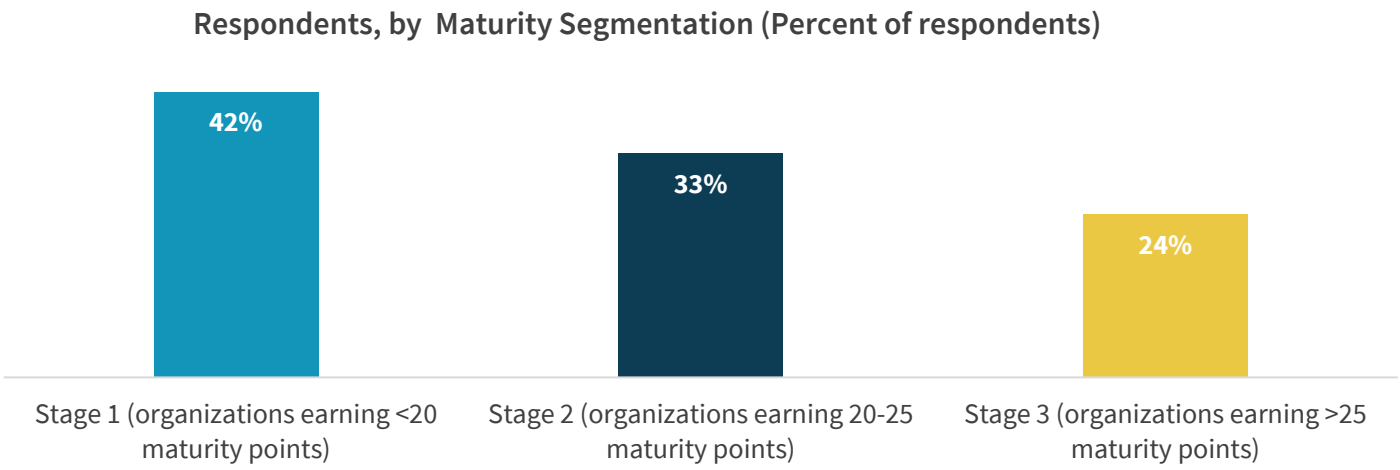
Based on those scores, ESG assigned each participant organization one of the following three levels of maturity:

- **Stage 1 (42% of organizations in the study):** Low levels of automation, very limited use of accelerators, and/or little to no converged/HCI based infrastructure for AI.
- **Stage 2 (33% of organizations):** Moderate levels of automation, some use of accelerators, and/or some converged/HCI based infrastructure for AI.
- **Stage 3 (24% of organizations):** High levels of automation, broad usage of accelerators, and/or high use of converged/HCI-based infrastructure for AI.

Figure 14. Allocation of Participants to Maturity levels



Source: Enterprise Strategy Group

Appendix III – Investment Tendencies Among Organizations Mature in their Use of Compute Optimized for AI

As part of this study, *Stage 3* organizations revealed some other investment and organizational tendencies that differed from those of their less mature colleagues. Some of the more significant differences include:

- *Stage 3* organizations were **2.2X more likely** than *Stage 1* organizations to identify having a **centralized data science team** (82% versus 37%).
- *Stage 3* organizations were **3X more likely** than *Stage 1* organizations to rate **performance as the most important solution characteristic** when selecting infrastructure for AI (24% versus 8%).
- *Stage 3* organizations were **3X more likely** than *Stage 1* organizations to identify as **storing 10PB or more** for its AI workloads (63% versus 11%).
- *Stage 3* organizations were **5.7X more likely** than *Stage 1* organizations to identify as being **highly effective at tiering data** in its AI workloads (63% versus 11%).

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