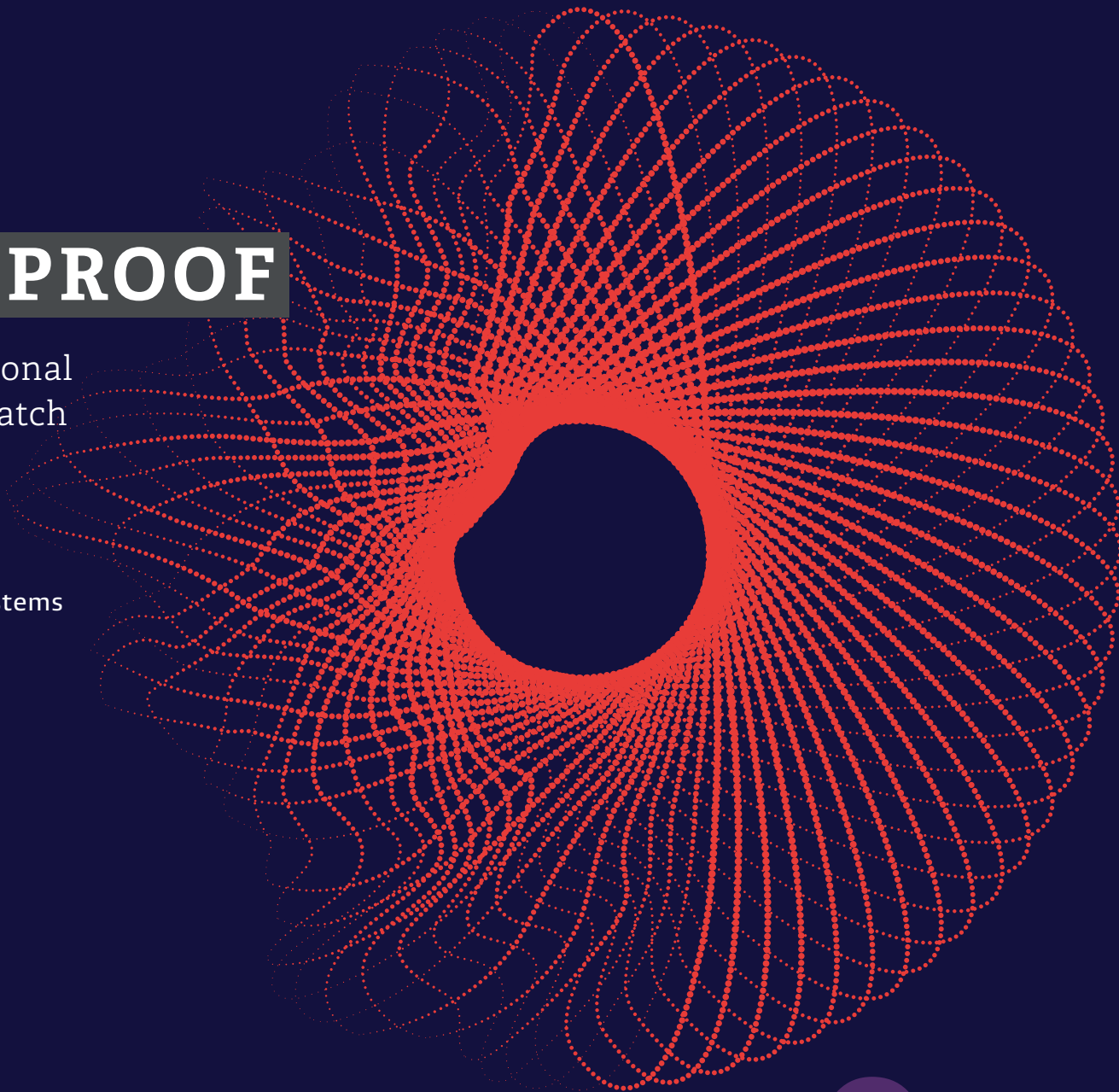


FUTUREPROOF

Creating an Operational
Infrastructure to Match
Your Ambition

Insights on Hedge Fund
Managers' Data Sets, Systems
and Hosting Decisions



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Software. Services. Analytics.

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| FOREWORD |

The global investment management industry is at an exciting inflection point.

For forward-thinking hedge funds and investment managers, the roles of the engineering, IT and operations teams are evolving from cost-center support functions to value-generating business contributors. Advancements in technology and smart outsourcing models have freed up precious time and talent for many firms, driving greater capacity to focus on understanding markets, solving for the biggest business problems and ultimately delivering alpha.

But how exactly does a savvy manager unlock the full potential of their technology and teams?

Hedge fund managers, and investment managers in general, are presented with a seemingly endless array of operational technology solutions, while the cloud and various service models make it easy for even the newest firms to get up and running alongside established juggernauts. Amidst this backdrop of innovation, though, many managers still struggle with rapidly aging legacy systems incapable of meaningfully evolving and point solutions stitched together behind the scenes producing untenable friction. Internal IT and operations teams who have mastered one way of working may find difficulty adapting to another. The Covid-19 pandemic has only served to emphasize existing challenges as well as reveal new ones.

Today more than ever, creating an operational infrastructure that works best for your business requires many complex decisions. The handful of simple questions below could generate endless discussion for most IT and operations teams:

- How can we better align our roadmap to the growth aspirations of the business?
- How could a single, unified, frictionless data set benefit our firm? How can we achieve that?
- How could our systems and teams work more seamlessly together?
- Should we migrate some or all of our data sets and systems to the cloud? Which kind of cloud and whose?
- Should we consider (or keep) on-prem hosting for some or all aspects of our business? Can we afford to build, secure and maintain it?

For most managers, the best path forward usually includes outside service providers for at least some aspects of their data and systems models. Having worked with more than 500 top hedge funds and investment managers to transform their operational ecosystems, Enfusion has first-hand experience in how managers can evolve successfully.

The key is to match your infrastructure to your ambition, ensuring it can meet your functional requirements today and, more importantly, your comfort level for risk as you grow and enter new markets and/or asset classes. And just as no one solution or path works for every manager, it's likely that your needs will also change as you grow. In choosing service providers, it's critical that you select a capable partner who has the ability to scale with you – and help you grow even more.

In that spirit, we offer this special report to provide insights into how hedge fund managers of all sizes, locations, and strategies are hosting and managing their data and systems. While our research was conducted before the Covid-19 pandemic took hold, we know from our ongoing interactions with hedge fund managers and investment managers that the unexpected shift to distributed, remote working has only elevated the importance of having remote access to data and accelerated the need to update technologies and infrastructure.

Throughout this report, we call out key takeaways for you to consider as you plan your own path forward. We hope these insights help you feel better informed and more prepared for the future.

If you are interested to discuss the findings in more detail with us, or to learn more about Enfusion's award-winning front-to-back SaaS platform and managed services, please get in touch. I'd love to hear from you.



Thomas Kim
CEO, Enfusion



EXECUTIVE SUMMARY



STATE OF THE CLOUD

The concept of the cloud has existed since the early days of computing, and in the last 25 years cloud-based solutions have gained traction among the majority of hedge fund managers. Where do things stand today, and what role will the cloud play in the future?

> Key findings:

- Cloud-based hedge fund managers report dramatic gains in efficiency and data security
- Concerns over data security, legacy systems and internal issues prevent on-prem managers from migrating
- Managers foresee roles for both public and private cloud hosting in the future



GETTING TO A GOLDEN DATA SET

Data is the lifeblood of any investment manager. But generating and acquiring more data create new considerations and challenges as well as opportunities. In this chapter we explore how hedge funds are hosting and managing their data sets. We also unpack their top data challenges and which challenges they plan to address with their spending in the year ahead.

> Key findings:

- Managers are getting more comfortable moving data to the cloud
- Proprietary analyst models remain most closely guarded on-prem
- Unifying multi-source data is hedge funds' greatest data challenge as well as their top spending priority for the year ahead



BUILDING SYSTEMS FOR SPEED AND SCALE

In designing an operational systems infrastructure, hedge fund managers face many critical decisions about their internal needs and capabilities, third-party solutions' functionality, how to connect disparate systems, and more. In this chapter we study where managers in different regions and size brackets choose to host their systems, and which particular systems get hosted where.

> Key findings:

- The hedge fund industry is fairly evenly split between cloud-based, on-prem and hybrid managers
- Sub-billion dollar hedge fund managers are the heaviest cloud users
- Cloud adoption leads nearly half of managers to be more open to outsourcing

| METHODOLOGY |

The findings in this report are derived from three key sources: a proprietary survey of hedge fund operations and technology professionals; interviews with hedge fund COOs and CTOs conducted in person and by telephone; and online research.

Survey responses were gathered during the first quarter of 2020, with 56 unique hedge fund management firms participating. The respondents were based in North America, Europe and Asia-Pacific (APAC), with the US and the UK accounting for the lion's share.

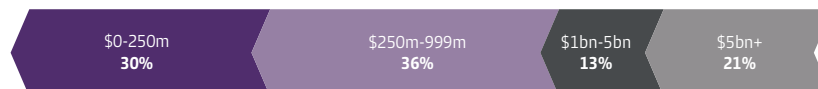
To facilitate peer benchmarking, in addition to survey respondents' location, we have captured their size, principal investment strategy and primary infrastructure hosting location (on-premises, cloud-based or hybrid). For managers with more than \$1bn in assets under management (AUM), we also break out certain topics by "lean-ness," i.e., number of operations staff per billion dollars in AUM.

Survey respondents by:

➤ Location of headquarters



➤ Assets under management



➤ Principal investment strategy



➤ Infrastructure hosting scenario



➤ Leanness of operations staff per \$billion in AUM (among \$1bn+ managers)





CHAPTER 1

STATE OF THE CLOUD

The concept of the cloud has existed since the earliest days of computing, and in the last 25 years cloud-based solutions have gained traction among the majority of hedge fund managers. Where do things stand today, and what role will the cloud play in the future? In this chapter we examine the benefits cloud-based firms have experienced, the barriers keeping on-prem managers wary of cloud migration, and where managers think the industry's infrastructure choices are heading.

Surveying the landscape of cloud scenarios

While the cloud has been ever-present in industry conversation over the last two decades, simply referring to “the cloud” as a single destination glosses over key differences in hosting scenarios. In the simplest terms, buying a cloud solution means using someone else’s hardware to run your systems. But the unique aspects of the different cloud computing models (and the different levels of services available) have significant implications for hedge fund managers’ operations. Here is an overview of the models and service levels.

HOSTING MODELS

The terms *public*, *private* and *proprietary* in cloudspeak refer to the exclusivity of access for each.

> **Public cloud (vendor-hosted):** This is what most people first envision when they think of “the cloud.” The big three names in public cloud are Amazon Web Services, Microsoft Azure and Google Cloud Platform. Public cloud providers own and operate core infrastructure, including hardware, software, servers and storage; public cloud resources are delivered over the internet.

Any company or entity can pay for access to a public cloud, whose infrastructure is shared among other cloud tenants. With public clouds, tenants can benefit from cost efficiency, on-demand scalability and high reliability without having to purchase hardware or software or do maintenance work. But while each tenant is provisioned with its own instance, public clouds are inherently shared resources. Dedicated private clouds may appeal to those who prefer higher levels of control and security.

> **Private cloud (vendor-hosted):** A private cloud provides many of the same zero-footprint benefits as public cloud computing, but is set up to meet the needs of one tenant, for higher levels of security and control. Private clouds may be run on dedicated hardware, which is more costly, or be structured as virtual private clouds, which share some underlying infrastructure for cost-effectiveness and greater scalability. In vendor-hosted private clouds, the vendor acts as a single administrator and can provide higher levels of service and support than a public cloud vendor might.

Because they are tailored to one tenant, private cloud environments can be easier to customize in order to meet specific business and IT requirements. Cloud providers working within the investment management sector are often SOC 2-certified, providing extra assurance of data security and controls.¹

> **Proprietary private cloud (self-hosted):** A proprietary private cloud is simply a private cloud hosted and administered by the tenant itself. In this scenario, a hedge fund manager would purchase or rent their own racks and hire an IT team set up and maintain the cloud infrastructure and services. This approach is not as common as vendor-hosted public or private clouds, and most likely to be embraced by the largest or most mature managers and multi-strategy shops, based on our research.

SERVICE LEVELS

The three levels of cloud service reflect increasing degrees of responsibility that reside with the cloud service provider rather than with the client. With each service level, clients are freed to worry less about the underlying hardware and infrastructure, so they can instead focus on their business’s functional requirements.

> **Infrastructure-as-a-Service (IaaS):** IaaS is the most basic form of cloud computing services. With IaaS, a cloud provider rents to the client the use of IT infrastructure on a pay-as-you-go basis. In this model, the client pays the vendor for access to servers and other datacenter infrastructure, while installing, configuring and managing their own software.

> **Platform-as-a-Service (PaaS):** PaaS delivers services one level higher in the tech stack than IaaS, to support application development. PaaS models provide operating systems, development tools, database management, application servers and analytics services. With PaaS, developers can focus on building their software on top of the platform and worry less about the physical hosting.

> **Software-as-a-Service (SaaS):** In a SaaS model, cloud providers host and manage not only the underlying IT infrastructure but also software applications delivered through the internet. In this model, clients simply subscribe to the service and bring users online. Clients of SaaS providers (such as Enfusion) benefit from easy implementations; effortless, built-in upgrades; and on-demand scalability. Plus, with providers who offer a connected ecosystem of applications, clients have the option of “turning on” other apps that seamlessly integrate with the ones they already use.

¹ SOC 2 stands for System and Organization Controls 2, a set of standards established by AICPA used to audit service organizations on the controls relevant to security, availability, processing integrity, confidentiality and privacy.

Cloud-based managers report improved efficiency and data security

The quest for operational efficiency – doing more with less, and doing it faster – has led many hedge fund managers to explore cloud-based solutions. The good news is that the cloud has delivered on this front, with 100% of fully and partially cloud-based managers reporting improvements in operational efficiency as a result of their migration (Exhibit 1.1). One European hedge fund manager's head of IT infrastructure noted that migrating to the cloud allowed for live, continuous data reconciliations rather than running them over nights and weekends.

Improved data security is another key benefit of migration experienced by both fully and partially cloud-based managers (72% and 50%), while two-thirds of fully cloud-based firms also report improvements in cybersecurity. These per-

ceived improvements in security are more prevalent among smaller (<\$1bn in AUM) managers, implying a more dramatic step-up from what smaller firms can manage (either on their own or with a managed services provider) to what a specialized technology provider can offer.

Real-time data access was also a notable benefit of cloud migration, reported by 39% of both fully and partially cloud-based firms. It is somewhat surprising that this did not score higher, given cloud hosting's real-time potential, but it may be that many respondents have not yet established a golden data set across internal and external sources. Precious seconds spent on syncing and reconciling disparate data sets may be standing in the way of true real-time access.

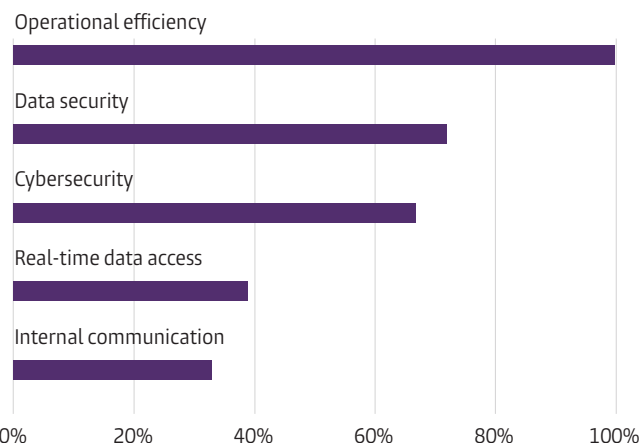
For many hedge fund managers, cloud hosting is almost a non-issue, and certainly secondary to the much more important issue of whether the software and services running on the cloud are living up to expectations. **“Cloud is so normal now that we don’t even talk about it much when meeting our service providers. We use what our service provider gives us and expect it to work,”** says the COO of an APAC equity hedge fund manager.

Key takeaway: Cloud-based solutions offer a wide range of potential benefits, but hosting location is ultimately less important than infrastructure functionality.

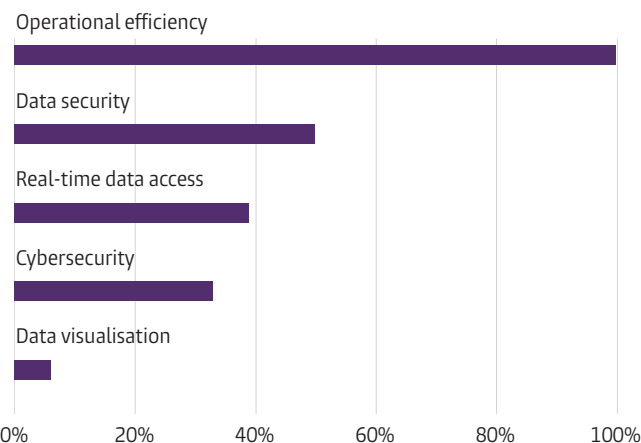
▶ 1.1 Manager improvements due to utilization of a fully or partially cloud-based infrastructure

Analyst note: Partially cloud-based managers use a mix of cloud and on-premises servers.

Fully cloud-based managers



Partially cloud-based managers



Cloud adoption enables managers to maintain — and redeploy — headcount

While cloud migration drives operational efficiency across the board, we found that not a single manager in our survey pool has reduced their headcount as a result of cloud migration. In fact, 96% of hedge fund managers who have migrated to the cloud have maintained the same level of operational staffing post-migration (Exhibit 1.2), while 4% have even increased their headcount as a result.

Initially we were very surprised to find zero reduction in headcount among our respondents post-cloud migration. As discussed on the previous page, one of the key benefits of cloud hosting is **“the ability to run a lean machine, with vendors doing all of the heavy lifting,”** as one interviewee

put it. But looking more closely at the results, we could see why this scenario makes sense. Hedge fund managers tend to cluster in one of two camps: those with a jack-of-all-trades COO and those with a top ops team. The former have leaned on their cloud infrastructure to avoid costly ops hires, while the latter have reassigned staff away from rote and repetitive tasks to more valuable ones such as managing client and vendor relationships, and helping with the firm’s internal digitalization and development efforts.

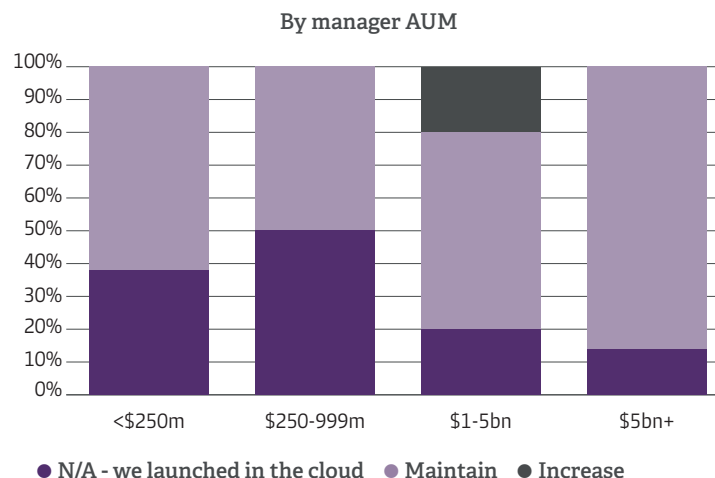
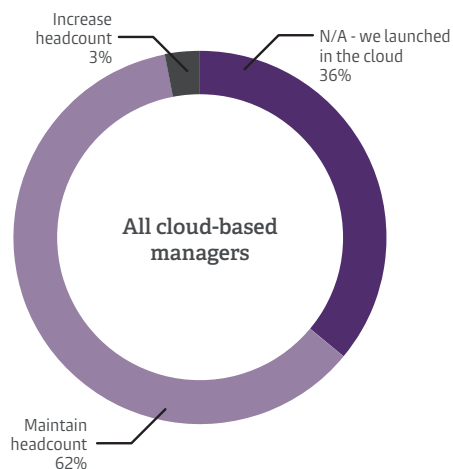
As another interviewee put it, **“The size of a team that is needed to support a modern hedge fund ops infrastructure is about a third to a half that of what it was 10 or 15 years ago.”**

Among the managers we surveyed, 36% had launched in the cloud, with younger, smaller firms most likely to have done so (44% of managers with <\$1bn in AUM). The much narrower pool of \$1bn+ managers who launched in the cloud (17%) clearly reflects the time of their founding, with the digitalization of the industry in its infancy at that time.

Key takeaway: Cloud adoption can free up valuable time and people, to help unlock your team’s full potential.

1.2 Change in headcount due to cloud adoption

Analyst note: Responses from managers that either fully or partially base their operational infrastructure in the cloud.



Data security fears, internal issues prevent on-prem firms from migrating

A whopping 81% of hedge fund managers operating a predominantly on-prem infrastructure say concerns over data security are holding them back from full cloud migration (Exhibit 1.3). Among our respondents, quant funds are most likely to employ an on-prem infrastructure, with fully 50% of them hosting analyst models on premises. For these firms, the sanctity of algos and strategies far outweighs the potential benefits of the cloud, even if three-quarters of fully cloud-based managers report that cloud adoption actually improved their data security.

Legacy systems are the second most commonly cited reason for resistance among on-prem and hybrid (partially cloud-based) managers. The difficulty of uprooting established systems, even if they are dated, can seem daunting if not impossible, especially for firms with lean ops teams. This scenario,

in which technology knowledge resides only with a select few, can create an over-reliance on staff over software, adding key man risk and technical debt.

Some of the other top barriers to full cloud migration reveal interesting assumptions about staffing, customization and cost. Hybrid managers' top barrier is insufficient tech resourcing internally – implying they believe they would need bigger or better teams to migrate and manage a fully cloud-based infrastructure. Taken in contrast to the efficiency and steady headcount associated with cloud adoption discussed previously, this concern may be more perception than reality.

Another barrier cited by both on-prem and hybrid managers, that their current setup allows for customization, implies that cloud-based solutions must be rigidly designed and not flexible. A good

cloud services partner should be asking for feedback and trying to incorporate client wishes into their development roadmap – to the benefit of all clients on their platform.

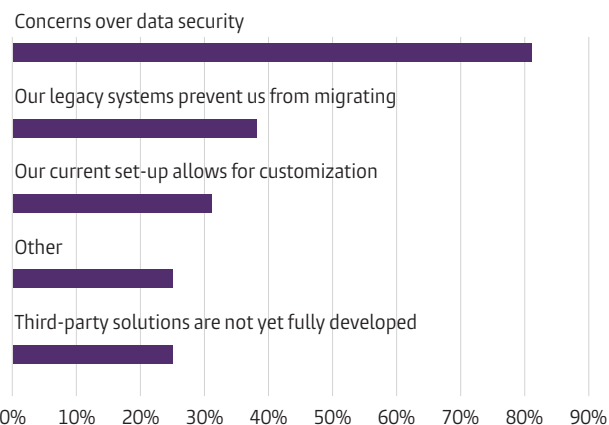
Despite the barriers to migration, a sense of competition among managers can create some urgency, as 24% of on-prem firms are concerned they are falling behind their peers when it comes to infrastructure, and three-quarters of those concerned firms do plan to overhaul their infrastructure.

Key takeaway: For some firms, there will always be valid reasons to keep part or all of their infrastructure on-premises – but some of the common assumptions about cloud migration might deserve a fresh look.

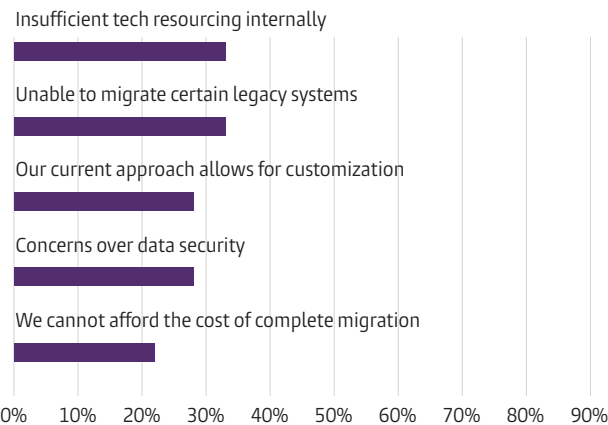
1.3 Top five barriers to full cloud migration among on-prem and partially cloud-based HF managers

Analyst note: on-prem hedge fund managers have infrastructure that relies on internal racks, while partially cloud-based managers use a mix of racks and cloud. Other* includes "time" and "cost/benefit."

Predominantly on-prem managers



Partially cloud-based managers



Hedge fund managers see roles for both public and private clouds in future

Considering the gains to be had in operational efficiency and data security, and the continued innovation within the cloud technology sector, it seems inevitable that cloud hosting of some kind will be relevant for most hedge fund managers into the future. But what are managers' sentiments about public and private cloud scenarios?

We asked respondents where they expect most hedge fund firms to host their core operational infrastructure five years from now: public cloud, private cloud, or a mix of public/private cloud. Managers' predictions skewed mainly toward a mix of public/private (43%) and public cloud (40%), with the remaining 17% predicting a primarily private

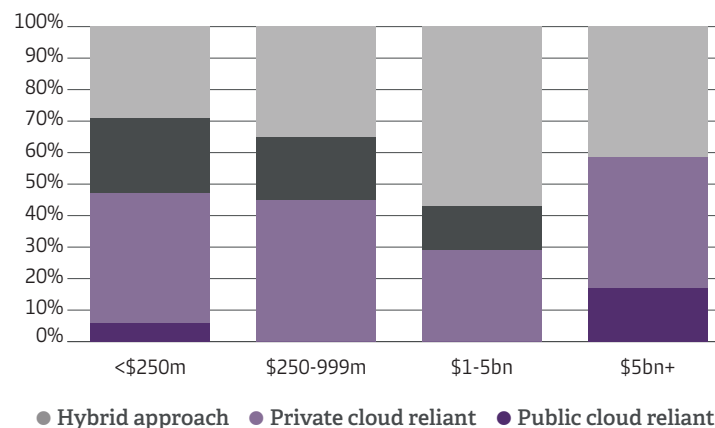
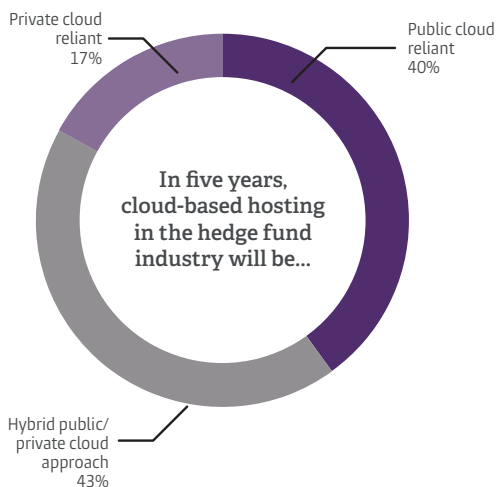
cloud future (Exhibit 1.4). In an industry where privacy and security are critical, it's not surprising that three-fifths of hedge fund managers overall believe at least part of a firm's infrastructure will be hosted on a private cloud. Interestingly, smaller firms are more likely to forecast private cloud's dominance, while \$1bn+ firms lean toward predicting public cloud reliance.

Against this cloud backdrop, there is still plenty of room for on-prem and hybrid (mix of on-prem and cloud) infrastructure models. For protective quant firms, for sensitive risk management systems, for the biggest managers who have the talent and budget, on-premises hosting will likely retain its

appeal. As one multi-billion dollar, multi-strategy manager's CTO states, **"We should not blithely assume that all managers will move to the cloud – many of the most sophisticated firms have taken a hybrid approach."**

Key takeaway: As managers weigh their operational priorities against their budgets and appetites for risk, we will likely see a continued mix of hosting solutions – public cloud and private cloud as well as on-premises.

1.4 Hedge fund managers' expectations for cloud-based industry infrastructure in five years' time



| SUMMARY |

Think functionality first, hosting scenario second

It can be easy to get mired in the cloud migration debate, because there are so many complexities and considerations to weigh. However, as Dan Groman, Enfusion's SVP, Global Head of Technology, puts it, **"The real question isn't whether you should go cloud or not, but rather what your required functionality is vis-à-vis your level of ambition and your comfort with risk. Once you have a clear picture of your business needs and your available resources, you will be better equipped with objective criteria for vetting potential service and software providers."** Are you looking for infrastructure-as-a-service, platform-as-a-service, or software-as-a-service? In other words, how much do you want to build and maintain?

If a platform's or solution's functionality fits your requirements, then you can look more deeply into its hosting model. Cloud-based solutions can certainly offer many significant benefits, from cost containment to on-demand scalability to the operational efficiency reported by 100% of cloud-based managers in our survey.

Two other crucial questions to ask of cloud-based vendors: Are their solutions cloud-native, or did they have to undergo their own cloud migration? And were their various components designed to work together seamlessly from the start, or have they stitched together disparate parts after the fact (or via/through acquisitions)? If you're looking to modernize and futureproof your own infrastructure, it's worth looking closely at the infrastructure of your vendors, too.



"The definition of operational efficiency has evolved significantly. It used to be defined in a department-specific, somewhat polarizing way between IT/operations and broader business interests. But today, operational efficiency can be defined at a macro, enterprise level – if your technology enables it. Alpha generation is no longer driven just by the portfolio manager or the trader – now it's an operational way of life."

– Frank Glock,
Head of Sales, EMEA, Enfusion



CHAPTER 2

GETTING TO A GOLDEN DATA SET

Data is the lifeblood of any investment manager. But generating and acquiring more data create new considerations and challenges as well as opportunities. In this chapter we explore how hedge funds are hosting and managing their data sets. We also unpack their top data challenges and which challenges they plan to address with their spending in the year ahead. Our findings will help managers benchmark against their peers and better prioritize their efforts.

Data sets are starting to tip toward the cloud, though on-prem racks persist

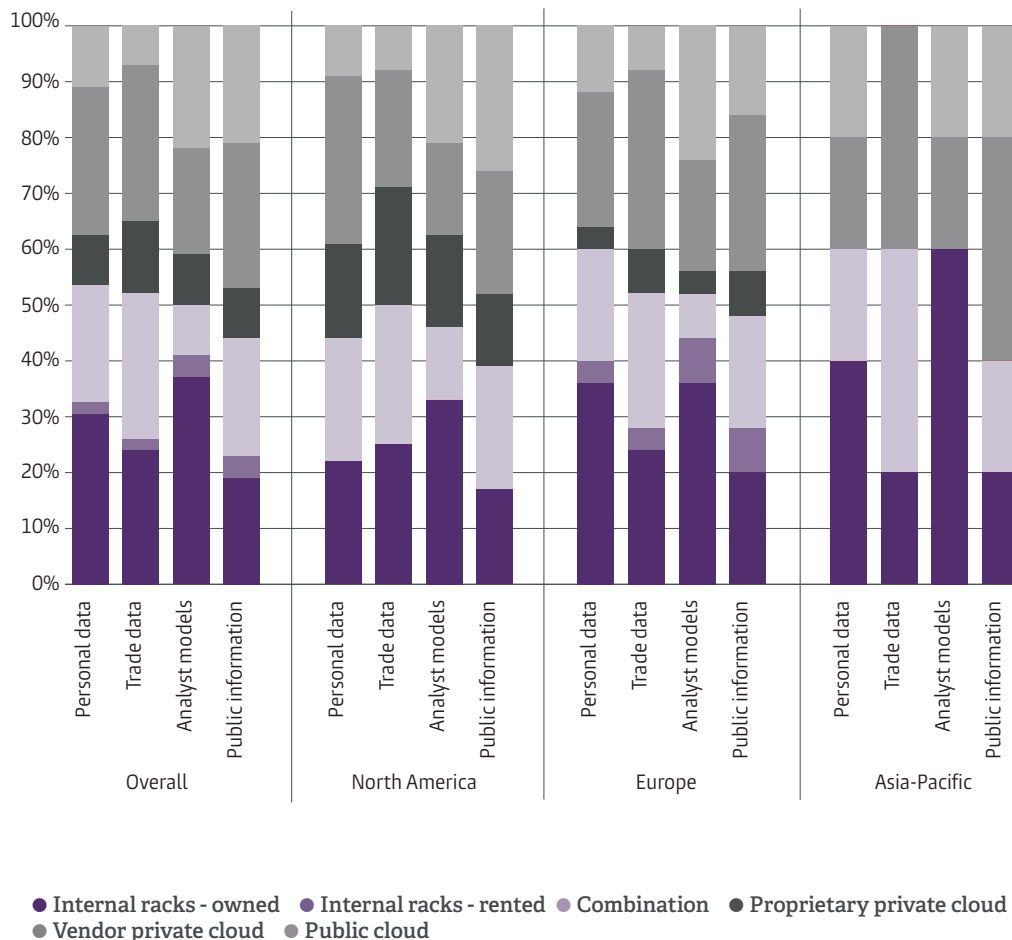
We start our exploration of managers' data sets by examining what data is being stored where. Overall, internal racks and vendor private cloud are the most commonly used means of data hosting among our survey respondents (Exhibit 2.1). Analyst models and other proprietary non-public data are most likely to be stored using internal racks, while most trade data sets flow through a vendor private cloud. As one hedge fund COO put it, **"Storing data on the cloud is not a concern for us, as long as it's not the most important data."**

It is little surprise that analyst models are most likely to be stored on-prem, particularly among quant firms (50%) and APAC managers (60%), since managers place the utmost importance on protecting their proprietary strategies. Of course, simply storing data on-prem doesn't guarantee stronger security; it requires strict controls and a highly skilled ops team in place. Considering that bigger teams likely have more specialized skillsets, it makes sense that over 80% of the \$1bn+ managers with the most ops staff (11 or more ops team members per \$bn in AUM) keep their analyst models on-prem.

Another key consideration is investors' concerns over where their data is stored. Interestingly, in Europe, where GDPR was supposed to have prompted a mass exodus to the cloud among businesses of all stripes, cloud hosting of personally identifiable information (the most onerous type of data to hold) actually proved lower than in North America and APAC. A COO based in Europe remarked, **"Even investors who are cloud users themselves can be nervous about their data being stored in the cloud by a manager."** No matter where managers are hosting their various data sets, they can assuage investor concerns through a thorough explanation of their data framework and security measures.

2.1 Where hedge fund managers host their data – by manager location

Analyst note: Trade data also pertains to sensitive company information, while analyst models pertains to proprietary non-public data.



Midsize firms take to vendor clouds, while the biggest firms build their own

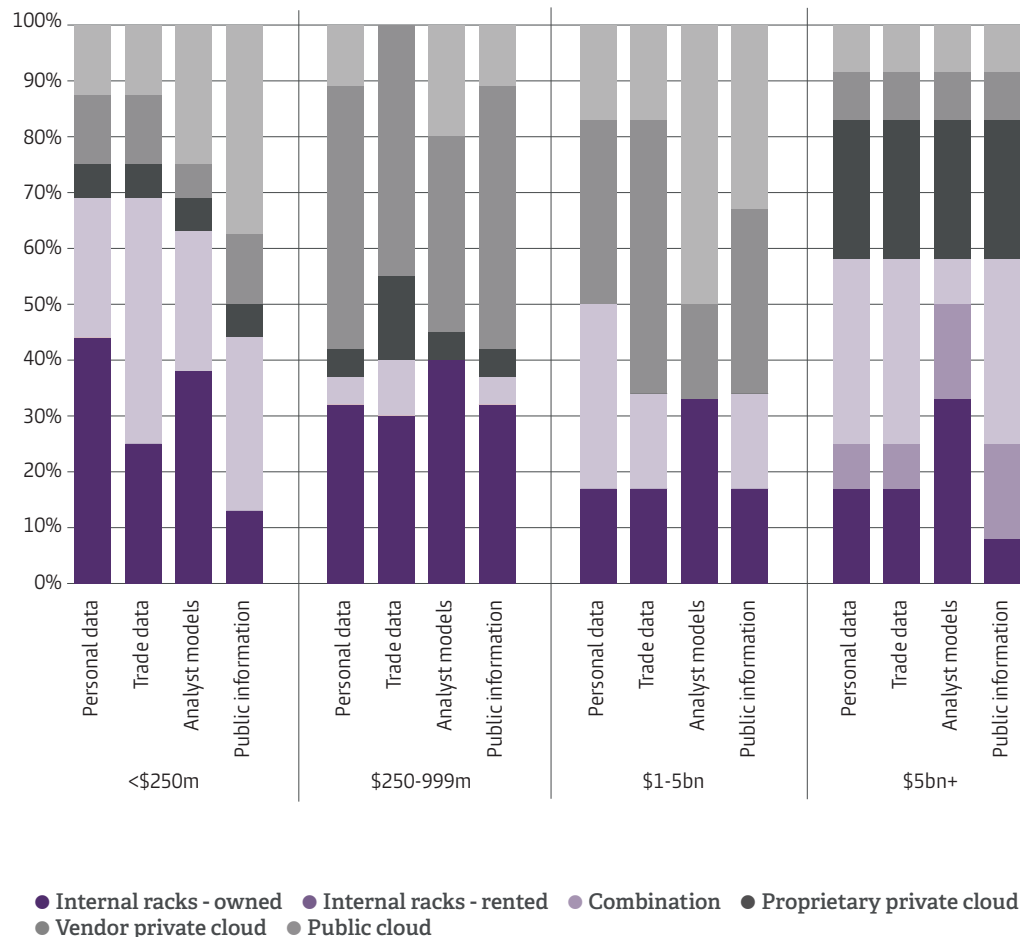
Slicing our data by manager size revealed a number of interesting trends. A hybrid model, combining cloud and on-prem data hosting, proved prevalent among both the smallest and largest managers (Exhibit 2.2). Mid-sized firms and those managing \$1bn-5bn were most likely to have embraced the cloud, with half or more of each hosting all categories of data in the cloud.

While conventional wisdom states that the industry will see a steady stream of managers switching to cloud hosting, one \$1bn+ CTO decried this vision as dated, suggesting instead that businesses will adopt a hybrid model of cloud and on-prem together. Our research offers some support for this prediction, as trade data and public information at the largest and smallest managers are most likely to be hosted in such a manner.

Potential benefits to a hybrid model include increased flexibility, lower latency, and potentially better security (depending on the controls and teams in place). Despite these plus points, such a model is likely to come at a greater cost to a manager and necessitate greater internal, technological expertise. Nevertheless, for those concerned about the security implications of fully cloud-based hosting, a hybrid model (especially one incorporating vendor private cloud) can serve as a stepping stone.

Key takeaway: Whether hedge fund managers choose to store their data sets on-prem, in the cloud, or in a hybrid model, they should feel confident in the security controls and people managing their hosting.

2.2 Where hedge fund managers host their data – by manager AUM



Combining multi-source data is the top data challenge for hedge funds

Combining data from multiple internal and external sources is the greatest data-related challenge faced by hedge fund managers, with nearly two-thirds (64%) reporting this as an issue (Exhibit 2.3). Surprisingly, combining data from different front, middle and back office systems was not cited by many managers as a challenge, except in Asia-Pacific (60%).

North American managers (73%) are much more likely than Europeans (58%) or Asia-Pacific shops (40%) to struggle with multi-source data. The make-up of our survey sample does not alone explain the North American struggle, as the compositions of our European and North American respondents are broadly similar in terms of size and sophistication.

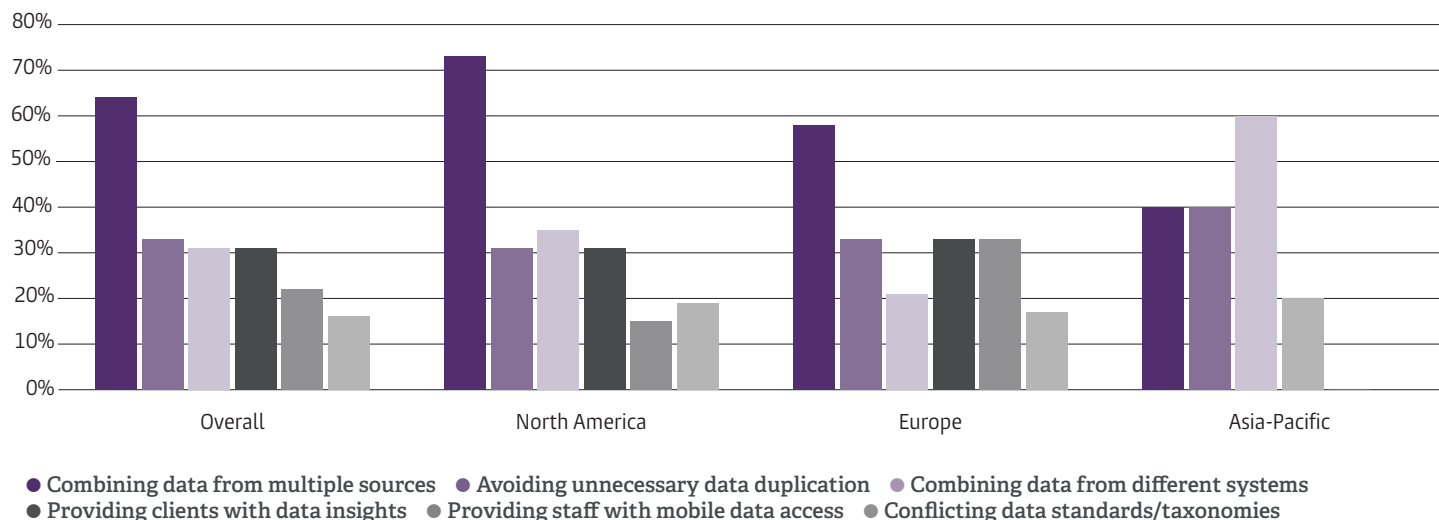
The answer must be instead in the nature of the US industry itself. North Americans' longer tenure often means a greater array of data sets used in analysis, while wider analyst coverage of US stocks means managers must employ ever more esoteric data sets to gain an edge.

Firms that cited combining multi-source data sets as a challenge were more than twice as likely to store their data in multiple locations: on-prem racks, private cloud and public cloud. These firms were also much more likely to use on-prem racks (53% vs. 35% among those not struggling with this issue), suggesting these factors may cause managers data difficulties.

Before a hedge fund manager can hope to create a golden data set, they must first reconcile disparate internal and external data streams. Vendors may be able to help, either through APIs, automated workflows, or managed services teams.

Key takeaway: Whether internal ops staff or external service providers are entrusted with combining multi-source data, it is a critical step in mitigating operational risk and reducing duplicative processes.

2.3 Significant data management challenges according to hedge fund managers – by manager location



Combining multi-source data is also managers' top spending priority

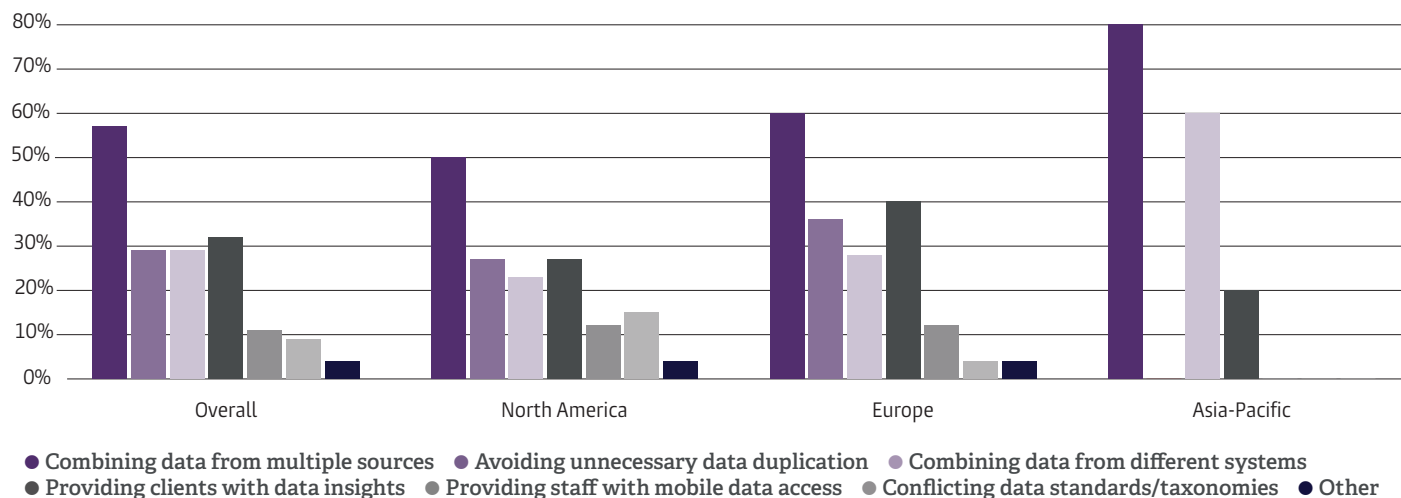
In order to tackle the challenge of disparate data, 57% of hedge fund managers plan to increase their spend on unifying data from multiple sources in the year ahead (Exhibit 2.4). North American managers and APAC managers exhibit differing levels of urgency on this issue: While 73% of North American hedge funds state multi-source data is a challenge, only 50% plan to invest in addressing it, while 100% of APAC managers plan to invest in addressing this challenge despite only 40% feeling it was a problem in their business. Three-fifths of APAC managers also demonstrate an unusual intent to increase spend on unifying data from their front, middle and back office systems.

With Covid-19 having caused the majority of hedge fund managers worldwide to enact their business continuity plans, the investment in providing staff with mobile access to data is already likely to have surged in recent months as firms seek to support a distributed workforce with remote working.

Meanwhile, 40% of European managers plan to ramp up spending to improve the provision of data insights to clients. Delivering insights is also likely to have risen on the list of priorities as managers seek to communicate more effectively with clients they are currently unable to meet with face to face. Managers' ability to incorporate these changes long-term will prove crucial to ensuring future business success.

Key takeaway: Before developing your spending priorities for the coming year, consider your greatest challenges and how much you would need to invest to address them.

2.4 Data-related areas where managers will increase their spend in 2020 – by manager location



Bigger hedge fund managers struggle with data duplication and extracting insights

The more assets a firm accumulates, the more likely it is to encounter data management challenges, as shown in Exhibit 2.5 – but no matter the size of the firm, combining data from multiple internal and external sources remains the greatest challenge.

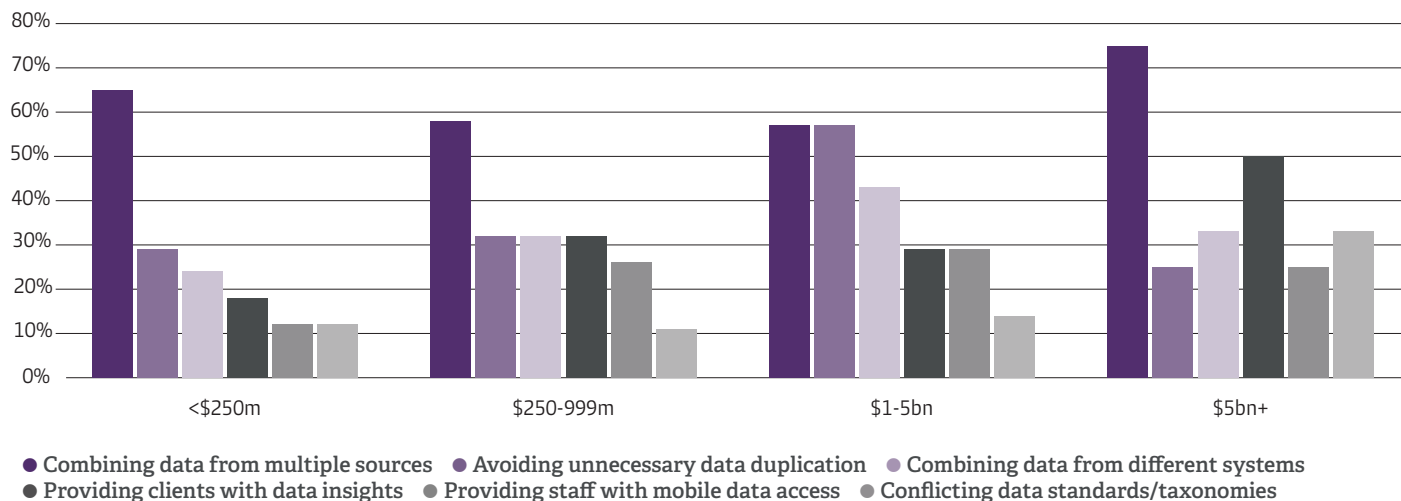
That 75% of the largest firms should still struggle in unifying various data sets is not surprising. Such managers are, after all, more likely to draw on different sources of intelligence to inform their investment processes and also more likely to utilize a greater number of distinct systems, generating multiple internal sets of data.

Hedge fund managers with more than \$5bn in AUM also cite the provision of data insights (50%) and conflicting data standards/taxonomies (33%) as problematic. One \$1bn manager's CTO noted that their investor relations and marketing teams are increasingly using P&L data in monthly factsheets to provide interesting commentary to investors, underscoring the potential value within the firm's data set.

Newer entrants to the Billion Dollar Club have a unique outlier challenge in data duplication (57%). Managers in this transitional \$1bn-5bn phase often migrate to new systems, but are left grappling with legacy tech, leading to data duplication difficulties, which can be hard for managers to overcome.

Key takeaway: As your firm grows and adopts new partners and systems, stay cognizant of the impact on your data hygiene and plan ahead for how new data sources can be integrated.

2.5 Significant data management challenges according to hedge fund managers – by manager AUM



The smallest hedge funds are focused on unifying their multi-source data

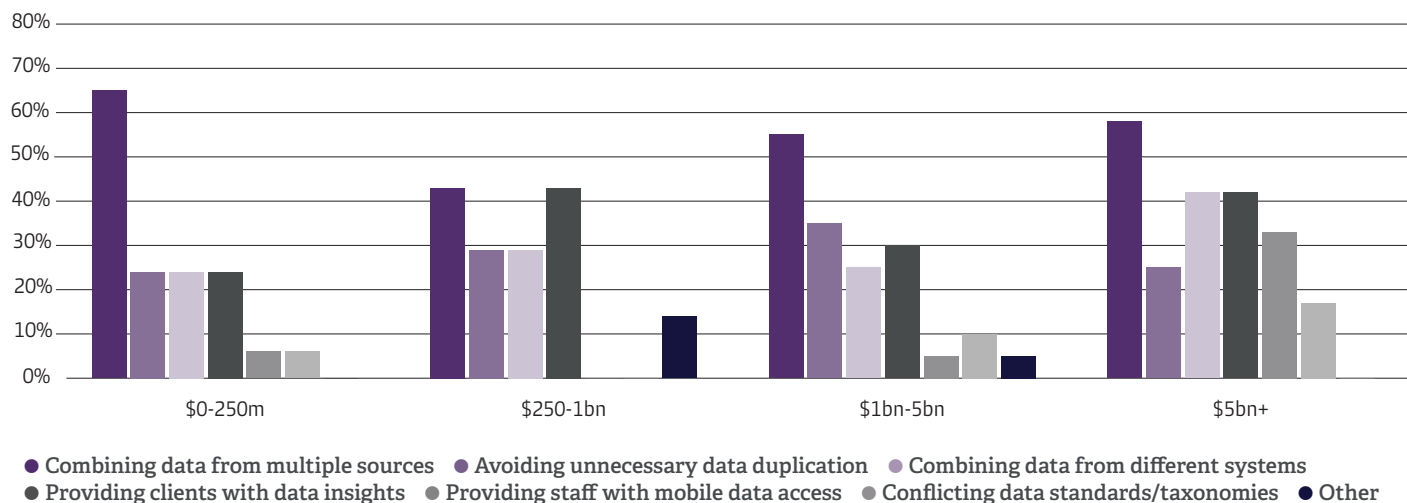
While the largest firms are most likely to cite combining data from multiple sources as a challenge, the smallest hedge fund managers are most likely to plan on increasing spending to overcome it (Exhibit 2.6). Beyond this anomalous finding, we see that as AUM grows, managers plan to spend more and more on addressing data challenges.

It may seem counterintuitive that <\$250m hedge fund managers are most likely to increase spend in the year ahead on combining data from multiple sources, as larger firms are more likely to say they struggle with this issue. But, data combination proved a significant challenge for two-thirds of small firms too, more than twice the proportion who find data duplication a challenge (65% vs. 29%).

The largest managers' greater ability to increase their spend comes as no surprise. More interesting is how they plan to invest — the proportion of \$5bn+ managers who plan to increase mobile data access spend (33%) is almost seven times the corresponding segment of managers in the \$1bn-5bn bracket (5%). This could signal differing priorities, but it may also be the result of swift mindset shifts in the early days of Covid-19. One large hedge fund COO claimed their firm received advanced warning from their prime broker of the severe fallout from the virus, prompting them to ramp up their spend in this area in February 2020.

Key takeaway: With fixed budgets and a number of challenges to address, invest in getting your foundational data set unified and cleaned up first, since it is the basis of many other key activities.

2.6 Data-related areas where hedge fund managers will increase their spend in 2020 – by manager AUM



Most managers use a consolidated operational infrastructure and data set

86% of managers use a single, consolidated operational infrastructure, making this the most widely used data management tool, while nearly seven out of ten managers report using a single, consolidated data set (Exhibit 2.7).

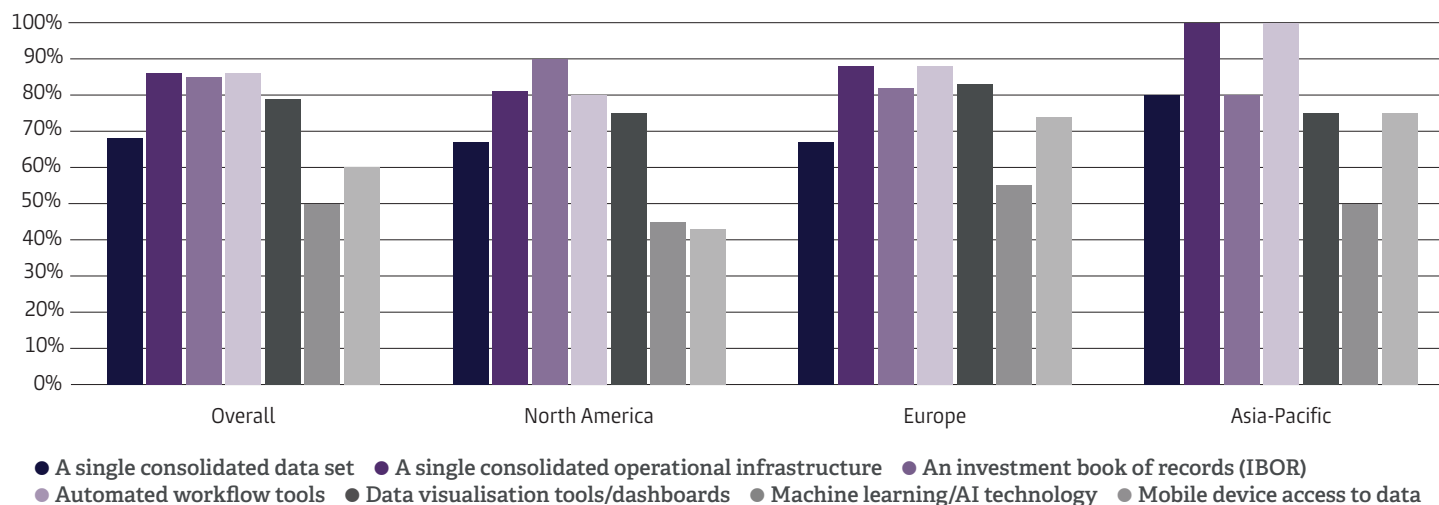
Given the considerable proportion of managers that report struggling with data combination and duplication, finding so many managers employing consolidated systems and data sets seems contradictory. Yet many of the managers we interviewed claim to have spent considerable time and resources on developing overlays to their systems in order to unify them. Indeed, for any given data management tool, the most common means of procurement is to develop in-house.

However, even if a manager's infrastructure or data set looks to be a single, consolidated entity, the "consolidation" actually relies on a patchwork of components that carries inherent problems. The more places where systems or data sets are stitched together, the more potential points of failure or data breaks there are.

When it comes to satisfaction with data-related tools, those managers using third-party, outsourced solutions are most satisfied overall. Third-parties may not always be able to provide the bespoke solution that some managers require, but for smaller firms they represent a cost-effective and efficient means of digitalizing the firm's data management.

Key takeaway: A stitched-together set of solutions might look and feel like a consolidated infrastructure, but managers should examine connection points closely to ensure truly seamless operation.

2.7 Tools used by hedge fund managers in their approach to data – by manager location



IBOR and automation are prevalent at the largest hedge funds

Nine out of ten managers in the \$5bn+ AUM range use a consolidated infrastructure and automated workflows (Exhibit 2.8), while 100% have adopted an investment book of records (IBOR). However, these largest hedge funds lag some of their smaller peers on having a consolidated data set and providing mobile access to data.

Having a golden data set makes records and reporting much easier across the board, because that one data set can simultaneously feed into IBOR and ABOR, as well as other connected systems. Again, it is surprising that more than half of hedge fund managers report using a single consolidated data set, given how many also struggle with unifying multi-source data.

Interestingly, the smallest hedge fund managers (<\$250m in AUM) are most likely to make use of machine learning and AI tools within their business. Perhaps their relatively younger firms are less tied down by legacy systems and hence freer to experiment with new tools. And among \$1bn+ managers, 100% of those with the leanest ops teams report using automated workflows to maximize efficiency.

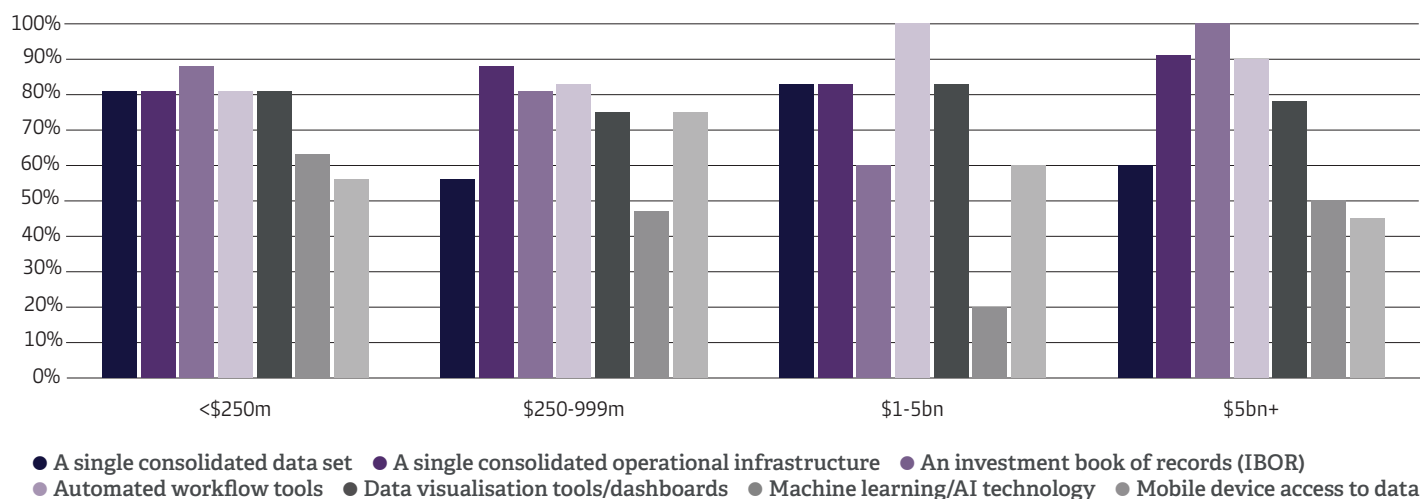
Key takeaway: When it comes to data management tools, the whole can be greater than the sum of its parts, because many of the underlying tools can work together to optimize operations.

Connecting disparate dots

“Outsourced service providers can help clients connect the dots across data sets and help to normalize and optimize data and processes. Plus, managed services teams at software firms are uniquely positioned to see opportunities for more effective data management and validation, influence roadmaps and act as expert extensions of the platform. It’s more like co-sourcing than outsourcing.”

– Dan Jacobs,
Global Head of Business
Development, Enfusion

2.8 Tools used by hedge fund managers in their approach to data – by manager AUM



| SUMMARY |

Prioritize protecting and unifying your data to accelerate growth

Data plays a critical role in alpha creation, especially if a manager's whole team can look at and work with a single golden data set in real-time. Better, richer, unified data leads to faster, more informed investment decisions as well as more powerful insights that shape a manager's roadmap and future. As such, optimizing data infrastructure should be a top priority for managers.

As more hedge fund managers become comfortable with storing data in the cloud or off-prem, it is important to consider the controls and security measures needed to satisfy internal concerns as well as investor concerns. For some, the appeal of keeping data on-prem is worth the significant investment.

If you are deciding where to host your data, here are some questions to ask:

- Do we have the budget and timeframe that make a self-hosted scenario worthwhile?
- Do we have or will we hire a skilled IT team capable of undertaking a self-hosted build and maintaining servers and security 24/7?
- Will our team be able to employ security controls that satisfy our investors' concerns?
- If our data set grows over time, are we ready to deal with rolling out upgrades on our own?

If these questions sound daunting, then cloud hosting with a trusted vendor is a wise choice.

The idea of unifying data sets across multiple internal and external sources can also seem overwhelming, but this top challenge is an important one to tackle. In an industry where real-time accuracy and speed are key, having a golden data set across systems ensures accounting, reporting and analytics all draw from the same central source, without issues of syncing lags or data discrepancies.

As you consider how to unify your data, you might ask yourself:

- Do we have an accurate data map or dictionary that captures all our data streams?
- Where are the weakest points of integration? What breaks are most common?
- Do our teams have a consistent view of the same information?
- Are there workflows or processes that could be automated or outsourced?

Because hedge funds live and die by their data, investing in a clean, streamlined, foundational data set is sure to pay off handsomely.



“Having a golden data set dramatically accelerates speed to market, which today encompasses much more than the speed of the actual execution. Speed to market should be measured from the moment a portfolio manager has an idea, through the interim compliance check, and finally to the execution itself, which is just one small part of the process. When you have a golden data set, the whole process is made lightning-fast.”

– **Bob Feng**,
Director of APAC Business,
Enfusion

The background of the slide features a person in a dark suit, seen from the side, holding a pen over a laptop. The scene is dimly lit, with a purple tint. In the background, there are faint, glowing line graphs and bar charts, suggesting a data-driven or financial context.

CHAPTER 3

BUILDING SYSTEMS FOR SPEED AND SCALE

In designing an operational systems infrastructure, hedge fund managers face many critical decisions about their internal needs and capabilities, third-party solutions' functionality, how to connect disparate systems, and more. In this chapter we study where managers in different regions and size brackets choose to host their systems, and which particular systems get hosted where. We also touch upon the important role that outsourcing plays in helping managers streamline their operations.

Hedge funds' systems hosting preferences are tipping toward the cloud

Our research shows that the hedge fund industry is fairly evenly split between cloud-based, on-prem and hybrid managers, although with 36% of managers, cloud just outpaced hybrid and on-prem as the most prevalent hosting solution (Exhibit 3.1). Adding together the cloud and hybrid (partially cloud-based) managers reveals that 70% of hedge funds are hosting at least some of their systems in the cloud.

Managers at different stages of asset growth also exhibit a broadly similar split, although mid-sized firms (\$250m-1bn) are more likely to be fully cloud-based (45%), while the largest hedge fund shops

(\$5bn+) are most likely to have a predominantly on-prem infrastructure (42%).

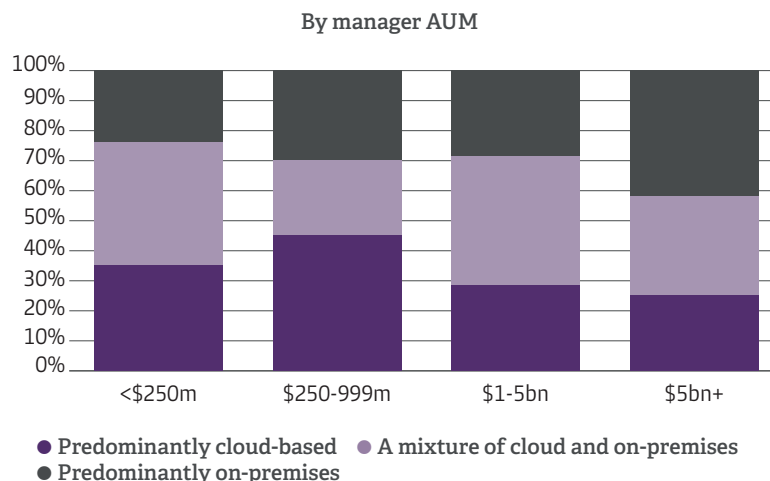
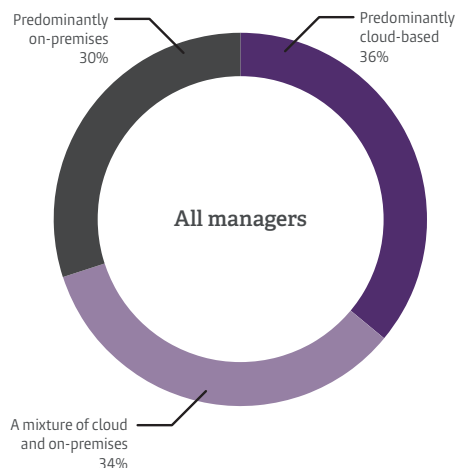
Managers that have launched in recent years are more likely to have started out in the cloud. Unburdened by issues such as legacy infrastructure, these managers have skipped one stage in their digitalization journey and can fully benefit from the speed and scalability that cloud enables.

There are other reasons some managers may keep on-prem and hybrid scenarios. One European billion-dollar firm's CTO stated, **"Certain vendor applications will still not run in the cloud,"** indicating that legacy systems may prevent cloud migration.

Others may prefer hybrid models, such as another CTO we interviewed who said, **"I prefer to supplement external systems with internal development to create tailored solutions."**

One European COO we interviewed feels that on-prem and cloud are broadly similar in terms of cost with the one front-loaded in a single wallop and the other spread over the period of the contract with the vendor. With internal racks typically having a five-year shelf life the COO in question says his firm plans to migrate to the cloud once their existing on-prem infrastructure runs out of steam.

3.1 Where hedge fund managers host their infrastructure



Hedge fund managers are more likely to host systems in the cloud than their data

Comparing hedge funds' hosting scenarios for their data sets vs. for their systems, overall, they are about ten percentage points more likely to have systems in the cloud. Managers are most likely to use a vendor's private cloud to host their operational infrastructure, followed by on-prem racks, according to our survey data (Exhibit 3.2).

North American firms are the most prolific cloud users overall. The penetration of cloud hosting of systems among North American firms reflects the region's early adopter status, as it is home to the hedge fund industry as well as to many top vendors' headquarters. With cloud-hosted systems, North American firms also seem to cut over completely rather than transition through a hybrid model (hybrid is used by zero managers in this region).

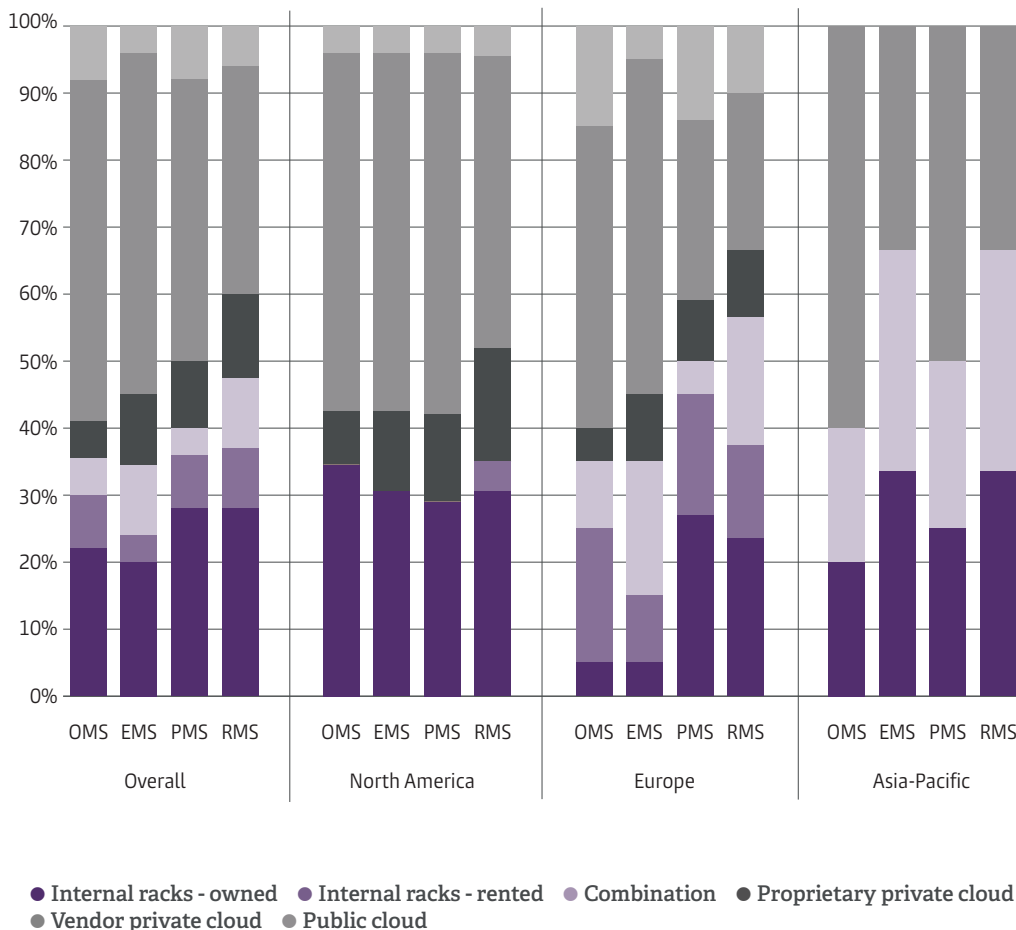
European managers proved the most diverse when it came to hosting solutions. Anecdotally, European firms tend to be more risk-averse and cautious in approaching the cloud. Although approximately half of all European managers host OMS and EMS systems with their vendor, every other category of hosting solution is used by at least a small portion of managers.

The COO of one APAC manager who migrated their systems to the cloud claims that it had become so ubiquitous that the decision was a no-brainer. The key issue was rather how to adapt to the new environment – an issue on which they sought guidance from their service providers.

Key takeaway: While one of service providers' key functions is to help clients in the migration to any new product or service, they are also there to act as higher-level partners. For those firms struggling with the integration of systems and data sets, look to your vendors for support.

3.2 Where hedge fund managers host their key systems – by manager location

Analyst note: OMS refers to Order Management System, EMS refers to Execution Management System, PMS refers to Portfolio Management System, and RMS refers to Risk Management System.



Sub-billion dollar hedge fund managers are the heaviest cloud users

Vendor private cloud is the most favored hosting solution among sub-billion dollar managers, with internal racks coming in second (Exhibit 3.3). The largest firms (\$5bn+ in AUM) are the most diverse when it comes to systems hosting, with no one solution having won out – perhaps a sign of established firms playing catch-up with the rest. This group is the only one to use rented racks or hybrid solutions to any notable degree.

The mixed hosting picture among larger firms implies extra complexity at the top of the industry. Managers who might want to evolve their hosting choices may struggle not only with legacy tech, but also with persuading CFOs and CEOs of the cost-benefit of migrating. Those firms requiring the highest levels of computing power may find a breakpoint at which on-prem is actually more cost-effective than the cloud. Interestingly, at the \$1bn+ managers with the leanest ops teams (<6 ops staff per \$bn in AUM), vendor private cloud is the hosting solution of choice for 80% of EMS and approximately two-thirds of OMS, PMS and RMS.

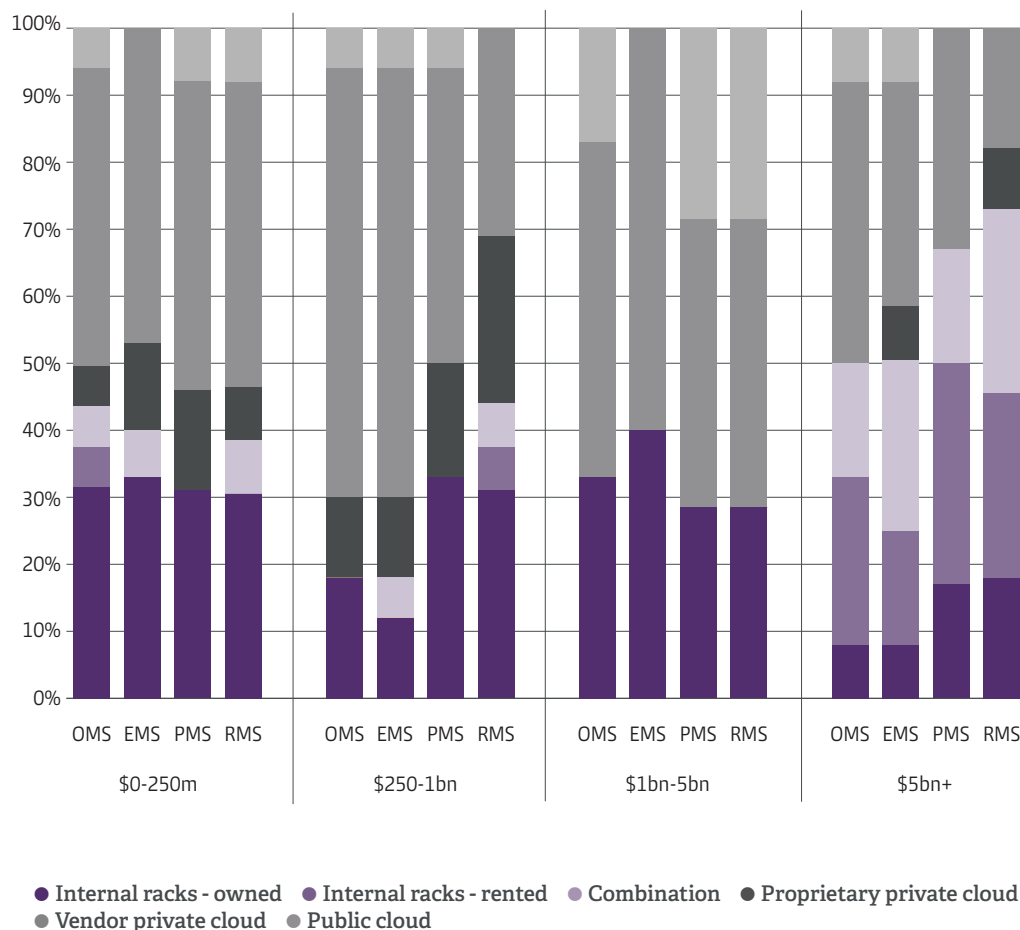
When it comes to satisfaction with the various systems hosting solutions, there is little discernible trend across managers no matter how the data is segmented. The lack of a clear picture likely indicates that manager satisfaction depends on specific circumstances and vendors, rather than on the hosting location itself. This analysis aligns well with a key takeaway from a previous chapter, that functionality is a more important consideration than hosting location on its own.

Beware of hidden costs

When considering a new hosting partner, be aware of sometimes hidden costs that can dramatically change the cost-benefit analysis. For example, is extra computing power on demand built into the solution's pricing, or will it be an extra charge? Be sure to investigate data egress charges, which can become hugely expensive especially with public cloud providers. Also, required upgrades every few years can often be very costly, sometimes as much as half the annual subscription rate. And if you should want or need custom development, will the cost negate any gains in operational efficiency?

3.3 Where hedge fund managers host their key systems – by manager AUM

Analyst note: OMS refers to Order Management System, EMS refers to Execution Management System, PMS refers to Portfolio Management System, and RMS refers to Risk Management System.



Cloud adoption leads nearly half of managers to be more open to outsourcing

Seventy percent of hedge fund managers outsource at least some of their operations, with the trend most prevalent among smaller managers (<\$250m in AUM) at 86% (HFM Insights, Q2 2019). As one COO mentions, **“As a smaller firm, it is easy to outsource. We were late to the game so that made it easy to get everything online without any legacy issues. I believe that is always the main issue [for others].”**

Adding to outsourcing’s appeal, cloud adoption (either full or partial) has led nearly half of all managers (44%) to say they are more likely to use outsourcing (Exhibit 3.4). The very largest firms (\$5bn+ in AUM) are the most likely to have greater enthusiasm (71%). A small fraction of firms (8%) say cloud adoption has made them less likely to outsource;

this was split between the smallest firms (17%) and the largest (14%).

While cloud hosting and outsourcing may not seem directly linked at first, a logical use case connecting the two is the outsourcing of cloud management, usually to a team at the cloud hosting provider itself. This scenario not only saves managers the time and effort and money required to train or retrain IT staff, but also entrusts the people who know their own solution best. It is also possible that migrating some aspects of their infrastructure to the cloud fosters a newfound open-mindedness among managers, who might see the benefits of bringing on an outside partner with specialized expertise in middle and back-office functions, for example. Outsourc-

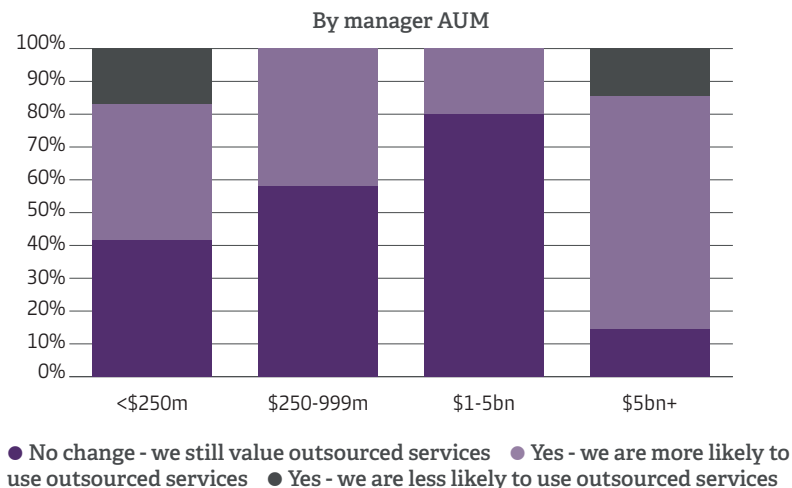
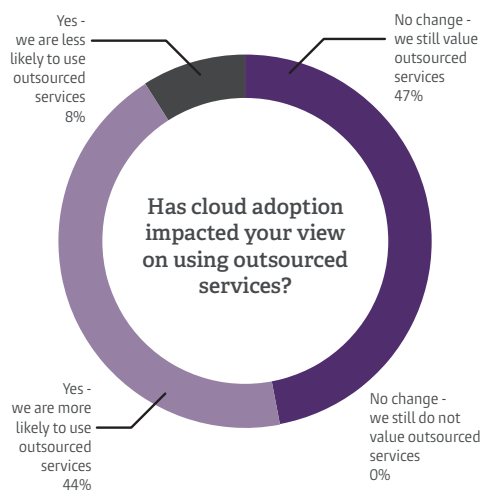
ing talent is a natural evolution from outsourcing technology.

One multi-billion dollar US-based COO adds color to this very scenario, noting, **“We used to have a lot of vendors. Ultimately, we want to have a single vendor and do everything else in-house. This would not only save time and money, but it would also be good to have additional specialist help for the firm.”**

Key takeaway: A thoughtful outsourcing strategy can be not only cost-effective but also value-adding, if your service provider brings expertise that would be difficult to build internally.

3.4 Proportion of hedge fund managers whose views on outsourcing have been changed by cloud adoption

Analyst note: Responses from managers that either fully or partially base their operational infrastructure in the cloud.



| SUMMARY |

Weigh your concerns against the potential benefits of cloud and outsourcing

While some managers may face the difficulty of legacy systems that cannot be migrated, other concerns around security, speed, and required staffing should be discussed with potential service providers. When it comes time to replace systems, it is likely that third-party providers can offer guidance, solutions and teams to help you make transitions smoothly.

Managers can avoid many of the potential issues by either embracing one seamless front-to-back platform or employing the talent needed to manage a multi-solution environment. The right service partner can help unify teams through technology, especially if their solutions are designed for extensibility. Particularly since many managers may need to take a gradual approach in updating their infrastructure, it is important that new solutions are designed to integrate and connect easily with existing systems (e.g., through APIs).

Here are some helpful questions to consider:

- What systems do we want or need to guard most closely? What is mission-critical in our intellectual property (IP) strategy?
- What functions or areas do we consider non-core to our business? (E.g., accounting)
- Would future on-prem software upgrades disrupt business and incur significant added costs?
- If we are migrating some systems to the cloud, what cloud model fits our needs and internal capabilities best: infrastructure-as-a-service, platform-as-a-service, or software-as-a-service? (See page 7 for more context)
- As we grow and need more computing power, are there additional costs associated?
- Does this service provider charge for custom development or for regular upgrades?
- Does this service provider offer managed services to alleviate rote reconciliation and processing work?
- How could we redeploy our operations team members if we transition existing systems to outside service providers?

Building an infrastructure that can keep up and grow with your firm is not a simple task, but supplementing your internal capabilities without outside expertise can often smooth the way forward.



“Stitching together different technologies can result in excessive reconciliation work and introduce multiple points of failure, due to the connections and active maintenance required to keep everything running in unison and at scale. A single and seamless system where all mission-critical applications are natively designed to interact together frictionlessly from the start are, by design, much more reliable and scalable, saving operations teams much unnecessary headache.”

– Michel Finzi,
Senior Managing Director,
Global Head of Product Management,
Enfusion

| CONCLUSION |

Optimizing technology and teams

“The ethos of your vendors is important, including tech vendors – do their values match with yours?”

– CTO, \$1bn+ equity hedge fund manager

As our research shows, there is no single path or solution for an ideal data and systems infrastructure. The optimal scenario is highly specific to each particular manager, based on their required functionality, level of ambition and appetite for risk.

One CTO we spoke with offers this sage advice: **“When choosing systems or putting procedures in place, CTOs should consider which business decisions they wish**

they’d made in three years’ time.” In other words, think beyond immediate needs, to consider the durability of potential solutions as the business evolves over time.

Ultimately, each branch of the complex decision tree leads managers to ask if they should build or buy. Below, we offer a summary of the key considerations and questions we have covered in this report.

First steps

- Take an inventory of your current software license(s), hardware, real estate and other necessary resources for “keeping the lights on.” Consider whether you feel you are getting the value you expect from your total investment.
- Shine a light on your data sets and systems to map every information flow and connection point. Identify where there are potential weaknesses and opportunities.
- Prioritize getting to a golden data set, to ensure an enterprise view of the same real-time data. The benefits of this critical step will cascade into addressing other common challenges, such as data duplication and extracting insights.
- Consider where automation and managed services can lighten the load of middle and back office functions. Leaning on outside partners can free up valuable time and talent internally for redeployment.

Hosting decisions

As you weigh the benefits of building vs. buying your hosting solutions, we offer these key questions to consider:

Build (self-hosted, on-prem or proprietary private cloud):

- Do you have the budget and time-frame that make a self-hosted scenario worthwhile?
- Do you have or will you hire a skilled IT team capable of undertaking a self-hosted build and maintaining servers and security 24/7?
- Will your team be able to employ security controls that satisfy your investors’ concerns?
- What aspects of your business do you want or need to guard most closely?
- Will future software upgrades disrupt business and incur significant added costs?
- Does your plan align well with and deliver on the firm’s one-, three- and five-year plan?

Buy (vendor public cloud or vendor private cloud):

- What cloud model fits your needs and internal capabilities best: infrastructure-as-a-service, platform-as-a-service, or software-as-a-service?
- With SaaS providers, do they have the ability to be truly cross-enterprise (vs. being a point solution)?
- Are the security measures and controls in place sufficient to protect your intellectual property and proprietary information?
- As you grow and need more computing power, are there additional costs associated?
- Does your service provider charge for custom development or for regular upgrades?
- Does your service provider offer managed services to alleviate rote reconciliation and processing work?
- How could you redeploy your operations team members if you transition existing systems to outside service providers?

Finding true partners

It’s nearly inevitable that you’ll lean on outside service providers for at least some aspects of your data and systems infrastructure. It is critical to think through the reality of your needs and internal capabilities as you vet potential vendors:

- Will they be a value-adding partner, not just a vendor?
- Do they show flexibility and open-mindedness as you discuss your needs?
- Does their innovation roadmap align with your firm’s trajectory? Is there room for your feed back to influence it?

We hope this report has provided insight into how other managers have carved their paths to date and how you might best carve your own path forward.

| KEY TAKEAWAYS |

Page 8

Cloud-based solutions offer a wide range of potential benefits, but hosting location is ultimately less important than infrastructure functionality.

Page 9

Cloud adoption can free up valuable time and people, to help unlock your team's full potential.

Page 10

For some firms, there will always be valid reasons to keep part or all of their infrastructure on-premises — but some of the common assumptions about cloud migration might deserve a fresh look.

Page 11

As managers weigh their operational priorities against their budgets and appetites for risk, we will likely see a continued mix of hosting solutions — public cloud and private cloud as well as on-premises.

Page 15

Whether hedge fund managers choose to store their data sets on-prem, in the cloud, or in a hybrid model, they should feel confident in the security controls and people managing their hosting.

Page 16

Whether internal ops staff or external service providers are entrusted with combining multi-source data, it is a critical step in mitigating operational risk and reducing duplicative processes.

Page 17

Before developing your spending priorities for the coming year, consider your greatest challenges and how much you would need to invest to address them.

Page 18

As your firm grows and adopts new partners and systems, stay cognizant of the impact on your data hygiene and plan ahead for how new data sources can be integrated.

Page 19

With fixed budgets and a number of challenges to address, invest in getting your foundational data set unified and cleaned up first, since it is the basis of many other key activities.

Page 20

A stitched-together set of solutions might look and feel like a consolidated infrastructure, but managers should examine connection points closely to ensure truly seamless operation.

Page 21

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Page 25

While one of service providers' key functions is to help clients in the migration to any new product or service, they are also there to act as higher-level partners. For those firms struggling with the integration of systems and data sets, look to your vendors for support.

Page 26

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Page 27

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About Enfusion

Enfusion's investment management software-as-a-service platform removes traditional information boundaries, uniting front, middle and back office teams on one cloud-based system and across one golden data set. Through our industry-leading software, analytics and managed services, we create enterprise-wide cultures of real-time, data-driven intelligence, boosting agility and powering growth.

A pioneer in developing innovative financial technology solutions, Enfusion partners with 500+ investment managers from 8 global offices spanning 4 continents. Enfusion was recognized by Aite Group as "Best in Class" for its Front-to-Back Portfolio Management System in 2019 and was named "Best Managed Services Provider" at the 2020 HFM EU Services Awards.

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