

Forrester Consulting

MAKING LEADERS SUCCESSFUL EVERY DAY

June 2009

Five Data Center Efficiency Moves To Make Today

A commissioned study conducted by Forrester Consulting on behalf of
HP

FORRESTER®



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Executive Summary

In May 2009, HP commissioned Forrester Consulting to evaluate how large enterprises can increase data center efficiency.

In conducting in-depth surveys with 185 IT professionals, Forrester found that these companies all suffered from inefficiency across many aspects of IT including: hardware utilization, IT process, and data center power consumption. All of our respondents were pursuing data center optimization projects targeting a broad cross section of their infrastructure and IT process.

Key Findings

Based on these optimization projects, Forrester recommends five key ways that firms can improve their IT efficiency:

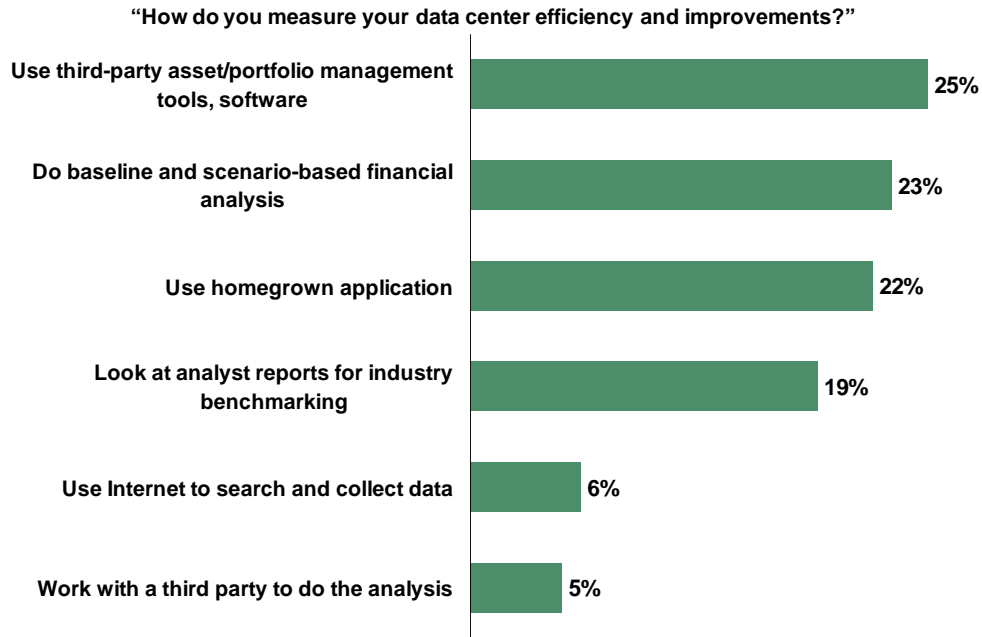
- **Baseline the environment.** Most companies suffer from a lack of information. For example, a substantial number of our survey respondents were not able to estimate the utilization of their server or storage infrastructure. Upon consolidating systems, many firms discover that a portion of their servers are ghosts — servers that are turned on but crashed or abandoned. Forrester suggests collecting both asset information including business owner, hardware configuration, and utilization before proceeding with further virtualization, consolidation, or data center infrastructure upgrades.
- **Virtualize servers.** Server virtualization is a valuable tool for reducing the number of physical servers required to run your applications. With many applications using just 10% to 30% of a server, the companies we surveyed found that they could put five to 10 of these applications on a single physical machine.
- **Consolidate IT.** Although virtualization can be a powerful tool for reducing your physical infrastructure, you'll be able to reclaim far more data center capacity by completely eliminating unneeded application instances. Most companies use virtualization and consolidation together to get the maximum reduction in physical infrastructure.
- **Improve data center energy efficiency.** The companies we surveyed put improving data center electrical efficiency at the top of the list of improvements they have undertaken. By reducing electrical consumption, you can realize immediate savings — as well as forestall expensive upgrades to your infrastructure such as additional uninterruptible power supplies and generators. After consolidating IT assets, look first for low-cost improvements such as unblocking airflow, installing blanking panels in racks, and plugging gaps in your raised floor around cable exits.
- **Update IT process.** Many of the optimization efforts pursued by our survey respondents focused on technology — virtualizing it, updating it, or getting rid of it. However, most of the companies we surveyed also examined their IT process for inefficiency. Few — just 9% — implemented all the ITIL processes. Most companies implemented critical IT processes such as incident, problem, financial, and configuration management.

IT Inefficiency Is Rooted In Related Issues

There's no single bad guy that can be blamed for IT inefficiency. Worse, inefficiency seems to grow incrementally over time as your environment becomes older and more complex. Each new application you add seems to require another server, which requires administrative time to keep running, while it consumes power, space, and expensive network ports in your data center. The companies we surveyed indicated they have a number of related problems:

- **No consistency in measurement tools existed.** Our survey respondents used a wide variety of methods to measure data center efficiency and improvements. However, our respondents were equally split between using external benchmarks, homegrown tools, financial analysis, and commercial asset/financial management tools (see Figure 1). With no clear leader, it is evident that measuring IT performance is difficult — yet only 14% of our respondents thought that they were less efficient than their peers.
- **Power efficiency of IT equipment is blamed for data center costs.** Many companies in our survey seem to think that their IT equipment is a significant source of electrical waste. When asked about which costs are important factors in data center efficiency, our respondents point to the efficiency of IT equipment — but not the sheer quantity of it (see Figure 2). Interestingly, few companies thought that underutilized servers or poor airflow were important factors.
- **Yet most respondents had huge numbers of underutilized servers.** Despite the concern over electrically inefficient IT gear, just 8% of our respondents linked low server utilization to data center costs. However, it seems that poor utilization is at least partly to blame, with nearly half of companies saying that prior to IT consolidation, server utilization levels were 0% to 30% — and many just didn't know.
- **Storage was no better utilized than servers.** Like their server environments, about half of the companies surveyed for this report estimated storage utilization at 0% to 30% prior to consolidation. Direct attached storage was slightly worse, since it lacks the ability to be shared between systems — but no type of storage was immune.
- **Little collaboration between IT and facilities existed.** Despite recognizing a strong link between data centers and IT efficiency, few of the companies we surveyed had a close relationship between IT and facilities groups. Many IT departments have to monitor power efficiency or electrical consumption for capacity planning purposes, but only about a third of IT shops say they are responsible for paying IT's portion of the electrical bill. In fact, 22% simply have no visibility into how much IT contributes to the bill at all.

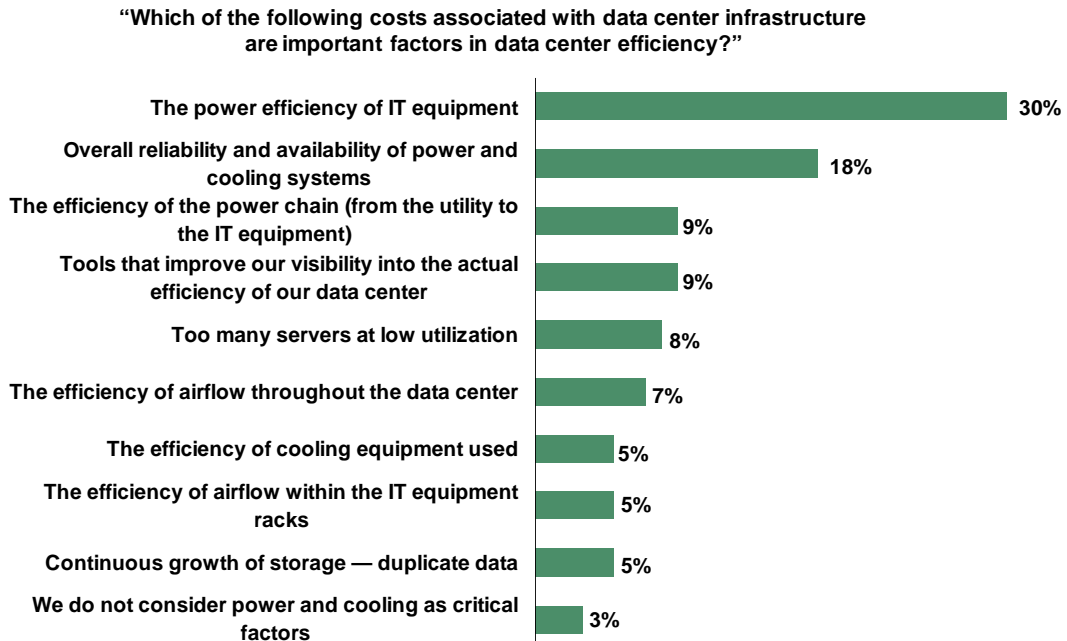
Figure 1: No Consistency In Measurement Tools



Base: 185 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Figure 2: Power Efficiency Blame Heaped On IT Equipment

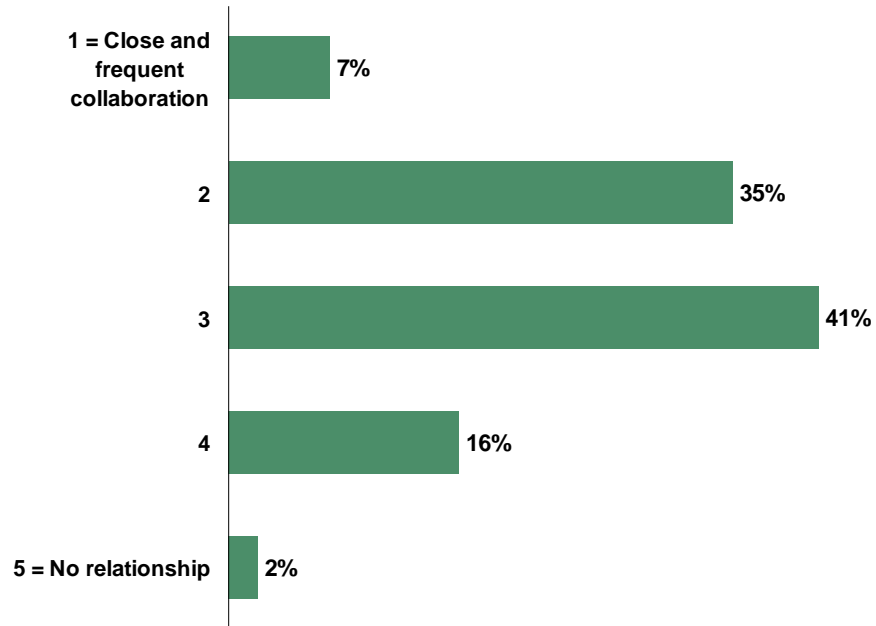


Base: 185 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Figure 3: There Is Insufficient Collaboration Between IT And Facilities

“Please describe how IT and facilities collaborate on improving data center efficiency.”
(On a scale of 1 [close and frequent collaboration] to 5 [no relationship])



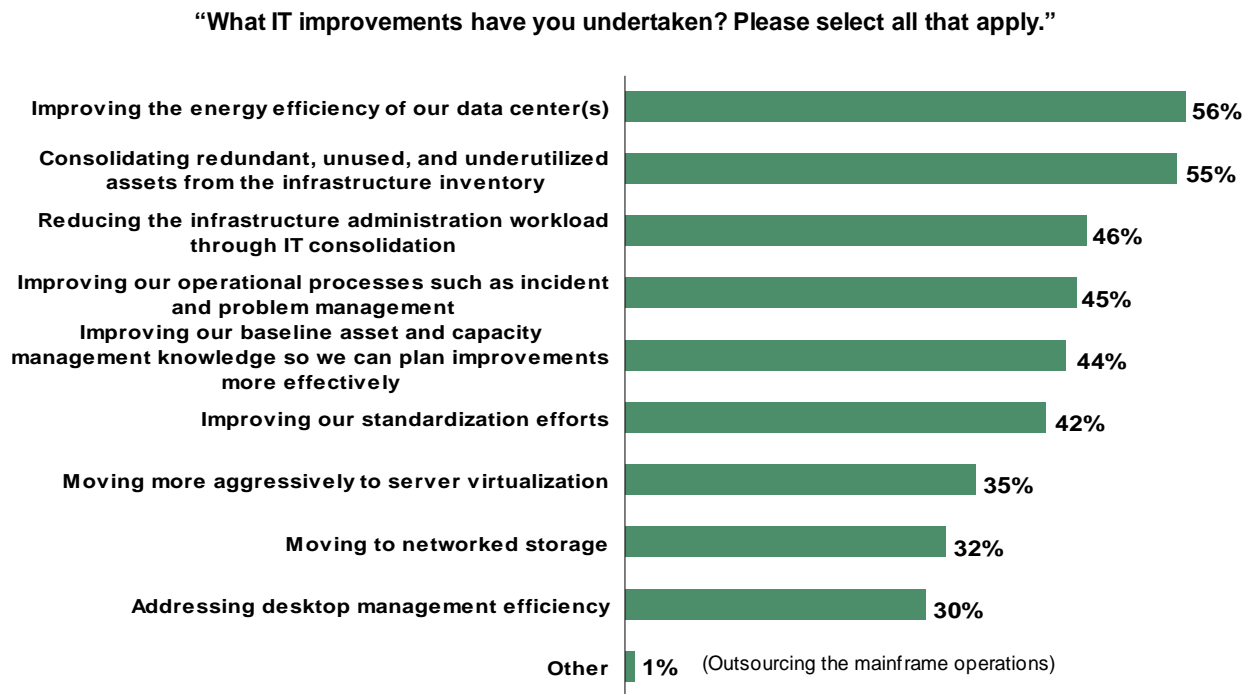
Base: 185 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Five Moves To Optimize Your Data Center

Forrester believes that the energy consumption, underutilization, and intensive administrative labor that contribute to data center inefficiency can be tackled by five key initiatives that you can begin immediately. Because inefficiency in the data center comes from many interrelated issues, firms are taking a broad approach to eliminating it. According to our survey respondents, the top IT improvements spanned data center energy efficiency, infrastructure consolidation, reduced administrative labor, and better IT process (see Figure 4). Some of the benefits received from different types of optimizations vary significantly across businesses of different types. In particular, companies with less than \$1 billion in revenue said that they benefited more from physical consolidation of IT assets, whereas companies with \$5 billion or more in revenue benefited the most from improving the energy efficiency of their data centers (see Figure 5).

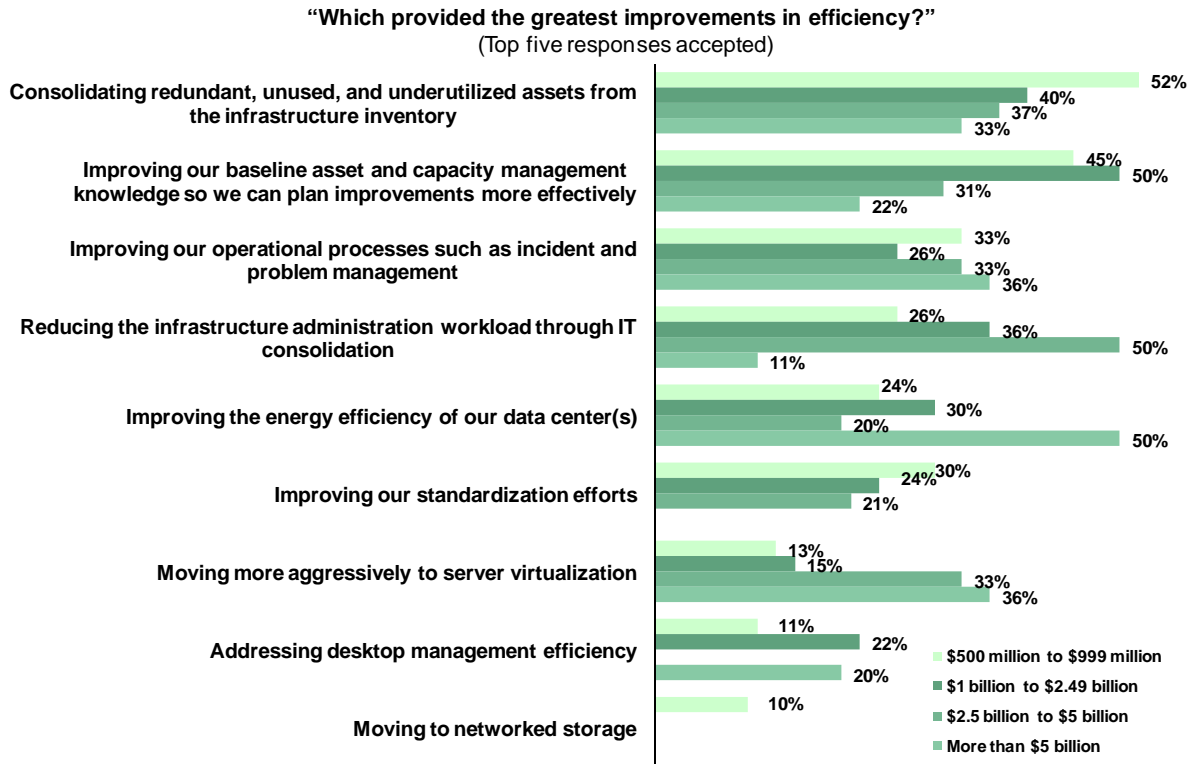
Figure 4: Data Center Efficiency And IT Consolidation Are Top Focus Areas



Base: 185 IT decision-makers (multiple responses accepted)

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Figure 5: Rankings Vary Widely By Size Of Business



Base: 185 IT decision-makers (multiple responses accepted)

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Baseline Your Environment

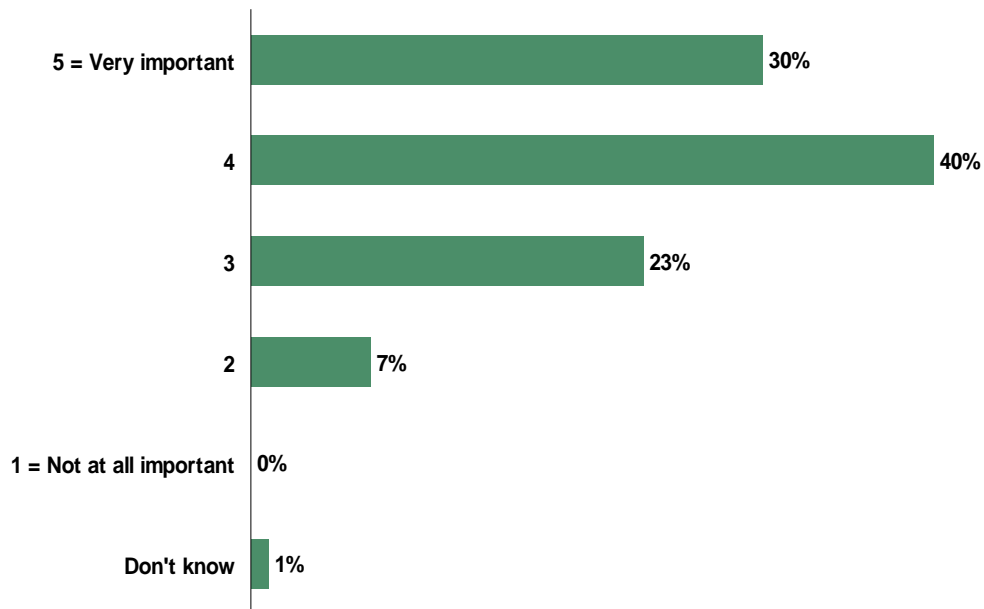
In order to get the maximum value out of a data center optimization program, you need information. As we have already seen, many of our survey respondents could not provide the average utilization of their server or storage environments. Maybe you already have this information, but it's trapped in a spreadsheet out of reach. When we asked IT professionals about the tools they use for tracking assets, 20% said they used spreadsheets extensively across multiple business units, while an additional 17% said they used it across all IT assets. Focus your efforts on developing the capability to collect and measure:

- IT asset inventory.** Knowing the age, hardware platform, and who's responsible for an IT asset is a critical part of IT consolidation (see Figure 6). Many of the companies we surveyed had (in addition to spreadsheets) one asset management tool or more from a major systems management vendor. The problem is that any given tool covered less than a third of our respondents' infrastructure. Therefore, your priority should be attaining as close to full coverage as possible — this can be simplified through tagging assets with bar codes or radio-frequency identifications (RFIDs). In addition, many asset management tools tie into their respective vendors' configuration management databases (CMDBs). This capability can be very useful in mapping out the interdependencies between servers and applications, which will be extremely useful in understanding who, if anyone, is relying on an apparently forgotten server.

- **Utilization data.** Aggregate utilization data can help you initially target particular servers and storage devices as candidates for consolidation. But it doesn't tell the whole story, since many servers are busy for short periods of time on a periodic basis. Use your system management tools to collect trends for the entire cycle of systems with apps that run on a weekly, monthly, or quarterly basis. Some capacity or consolidation planning tools can simplify this task by superimposing historic data for multiple systems to simplify analysis.
- **Performance modeling and consolidation planning.** To optimize your consolidation scenarios, consider using performance modeling and consolidation planning tools to analyze different consolidation and virtualization scenarios. In large optimization projects, it will take forever to manually select potential targets as well as determine the optimal number of systems and which servers should host which apps. Modern planning tools take a mathematical approach to optimizing capacity while minimizing configuration conflicts between dissimilar systems or those that will compete for resources at the same time.

Figure 6: Most Acknowledge The Importance Of IT Asset Planning Tools

“Please rate the importance of IT asset planning tools to your consolidation planning.”
(On a scale of 1 [not at all important] to 5 [very important])



Base: 185 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Virtualize Servers

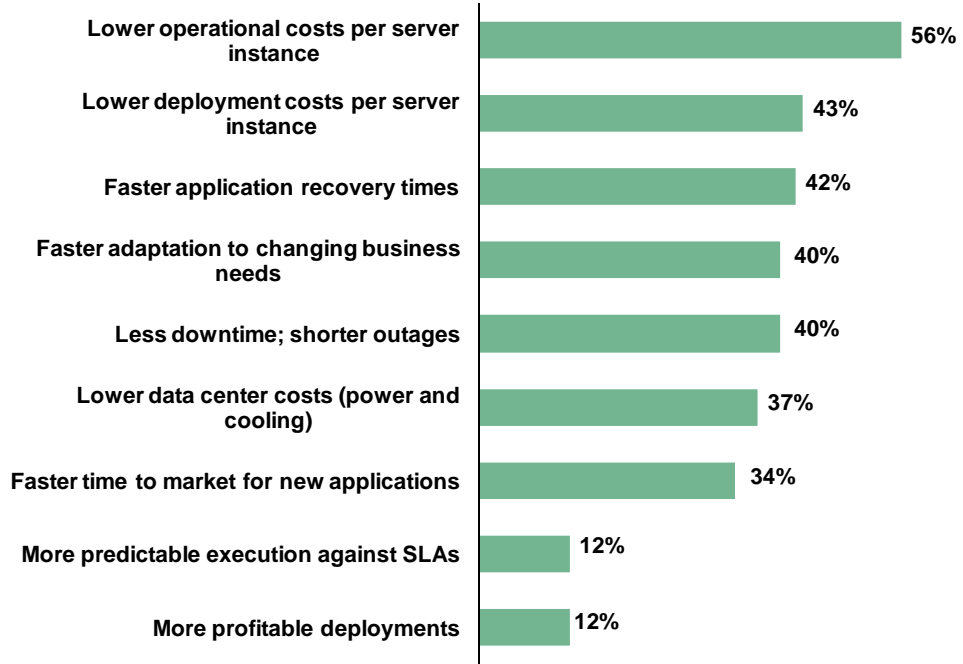
Server virtualization — particularly among x86-based systems — is a key component of an IT optimization program. One of the main reasons for its popularity is its quick path to savings, with many of our respondents experiencing lower operational costs per server and lower costs per server instance (see Figure 7). Server virtualization complements overall IT consolidation projects by allowing firms to share capacity across multiple underutilized systems and shrink the hardware footprint of applications that cannot be completely eliminated. To reap the maximum benefit from your virtualization efforts:

Five Data Center Efficiency Moves To Make Today

- **Virtualize aggressively.** Most firms are now virtualizing their production environments. Among the firms we surveyed, 60% said that they were using it for some production systems or extensively within production, with only 18% limiting virtualization to testing and development systems (see Figure 8). On average, firms have virtualized about 25% of their environments so far but anticipate making aggressive progress over the next two years, at which time they want to be 70% virtualized, on average (see Figure 9).
- **Use virtualization to improve service levels.** Many companies are completely focused on reducing hardware and operations costs with virtual servers, yet overlook significant improvements to disaster recovery and faster time to market for applications. By offering improved service levels for virtualized servers, you can accelerate your internal customers' migration to virtual infrastructure, while improving overall satisfaction with IT services.
- **Increase utilization with advanced management.** There is still room for improvement, however, as many firms leave a substantial amount of headroom on their virtual server hosts (see Figure 10). Today, many firms put just five to 10 virtual machines (VMs) on a server, while more experienced organizations are putting 25 to 30 VMs on a single server. Many administrators are reluctant to run servers at maximum capacity because they are concerned about the possibility of performance problems that could affect multiple applications simultaneously. In order to get to higher levels of hardware utilization, improve your administrators' visibility into the performance and availability of the virtual infrastructure with management tools designed for virtual servers. You can also use active power management software to help power your server infrastructure up and down depending on demand for applications. This is particularly useful in virtual environments where you can use live migration to consolidate VMs onto as few physical servers as necessary to maintain service levels, shutting down the rest. According to our research, 46% of the firms we surveyed are using active power management software in some form.

Figure 7: Cost And Time-To-Market Efficiencies Are The Top Benefits

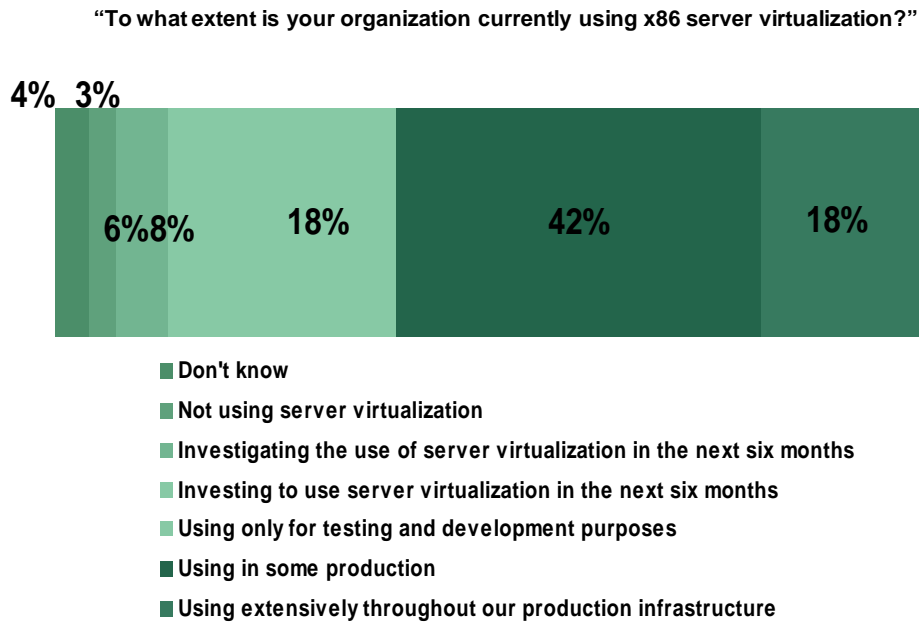
“What business benefits are you experiencing through your implementation of virtualization?
Please select all that apply.”



Base: 185 IT decision-makers (multiple responses accepted)

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Figure 8: Use Of X86 Server Virtualization Is Strong

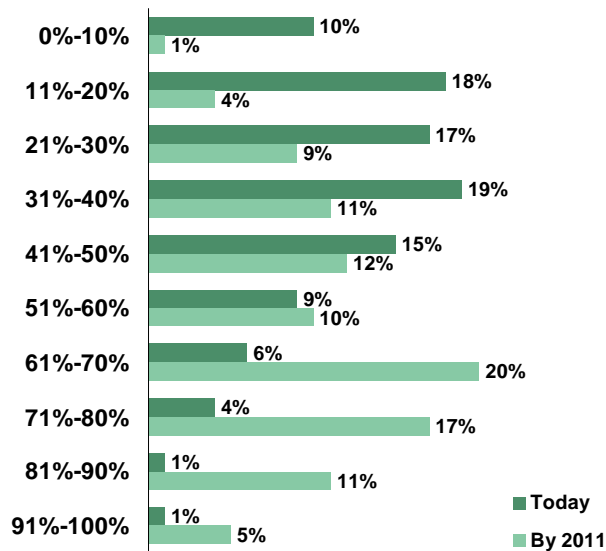


Base: 185 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Figure 9: Virtualization Adoption Is Quickly Moving Toward 70% Of Servers

“What percentage of your server systems are virtualized today and will be by 2011?”

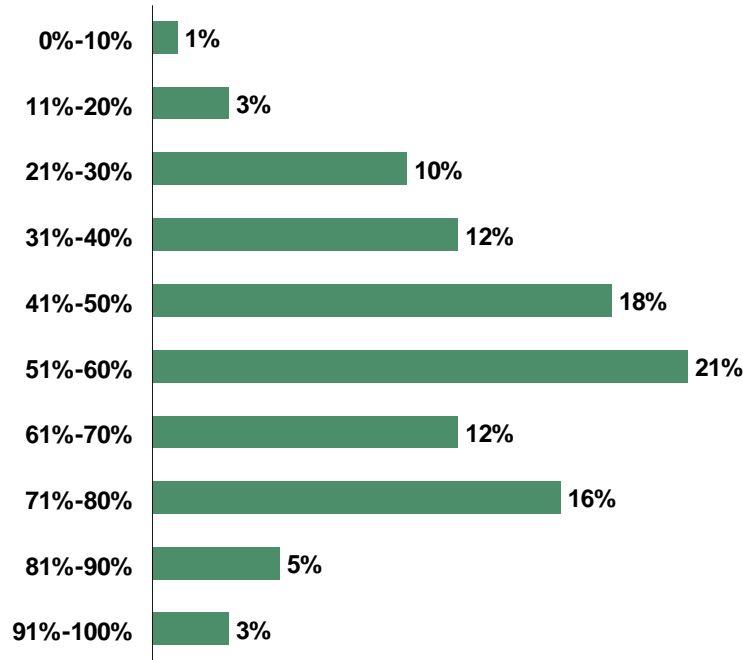


Base: 185 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Figure 10: Almost Half Of Firms Plan To Run At Less Than 50% Utilization

“What is your preferred or target average system utilization for the physical servers in your virtual environment?”



Base: 185 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

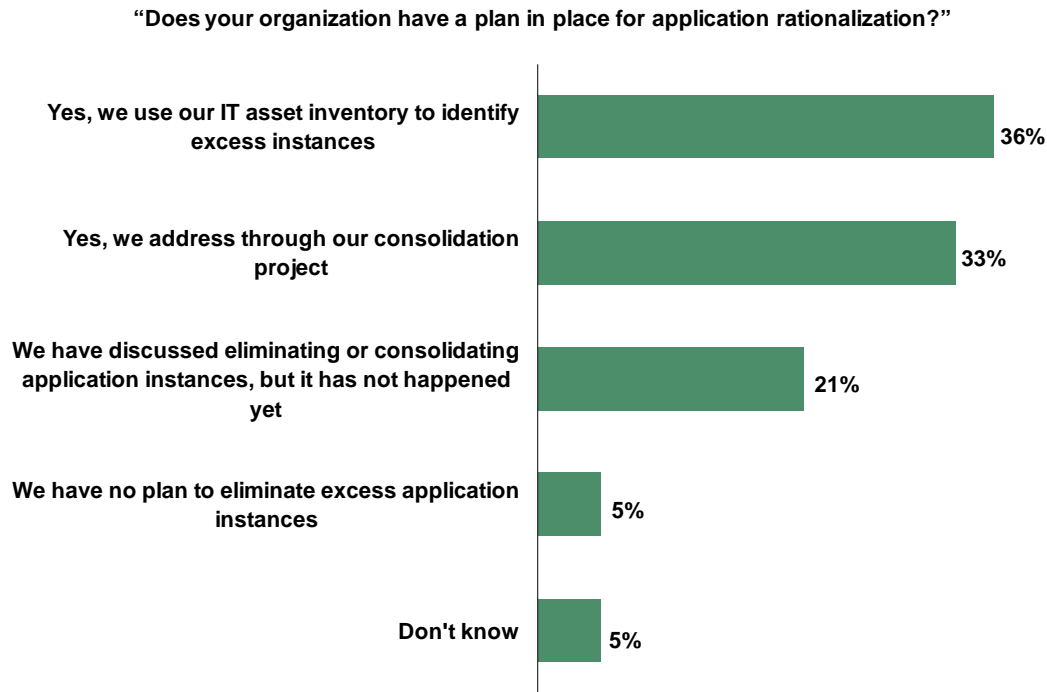
Consolidate IT

The best way to reduce hardware, labor, and facilities costs is to unplug unneeded infrastructure. But it takes legwork and detailed information on your assets to do it right. Prior to consolidating, more than one-fifth of our respondents found that 15% to 20% of their servers were ghosts — turned on but in a crashed or abandoned state. Without detailed information about server ownership and utilization, it would be hard to identify some of these systems. Once you have your baseline information in hand, you can:

- **Focus on reducing operational cost.** Based on Forrester’s prior research, we have found a marked difference in the way that firms with prior consolidation experience measure their success. Inexperienced firms tend to measure consolidation success by the percentage reduction in their IT budget, whereas experienced firms focus on the percentage reduction in operational costs.
- **Eliminate application instances when possible.** Virtualization complements IT consolidation but cannot replace it. Even after virtualizing, you’ll still be paying for the maintenance of the same number of application instances, even if they use less equipment to run. As a result, companies frequently struggle to reduce operational costs on the basis of virtualization alone. Of the companies we surveyed, most rationalized applications through the use of their IT asset inventory or their consolidation project (see Figure 11).

- **Consolidate storage into networked pools.** Direct-attached storage is usually blamed for firms' low storage utilization. However, our respondents found that networked storage can also suffer because of over-provisioning and isolated storage area networks (SANs). You may already be paying for intelligent arrays with virtualization, thin provisioning, or deduplication features waiting to be turned on.

Figure 11: Application Rationalization Is A Second-Phase Effort



Base: 185 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Improve Data Center Efficiency

Upgrades to your data center's power and cooling infrastructure are extremely expensive and time consuming. For example, it can take upwards of nine months to obtain a new generator, which is why so many firms in our survey are determined to fit within their existing constraints. There are many opportunities to reclaim capacity (and reduce electrical costs) in your data center by making both small and large adjustments. Improving data center efficiency was especially important to the largest companies we surveyed. Among firms with more than \$5 billion in revenue, 50% included data center efficiency among their top five improvements that provided the greatest benefit — twice as many as firms of other sizes. In addition, with UK regulations beginning to penalize large consumers of electricity, we found that UK companies are now significantly ahead of other countries in their interest in greener technologies such as energy management software and more modern power and cooling infrastructure (see Figure 15). To optimize your facilities' energy efficiency, you should:

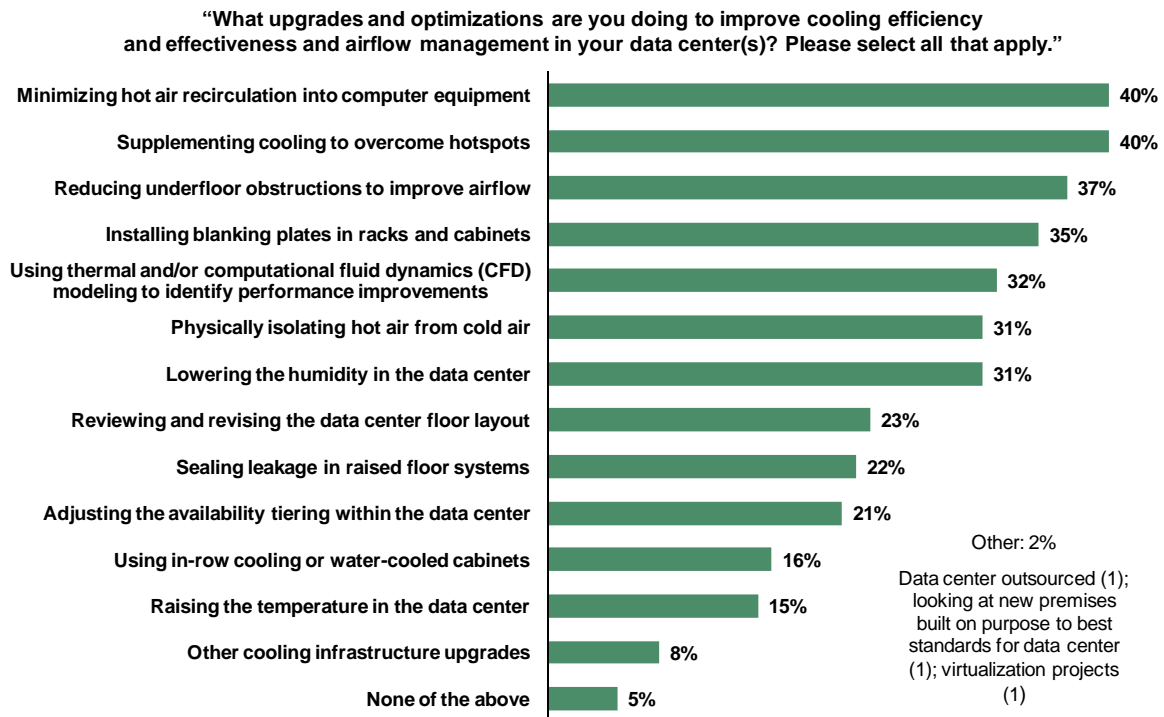
- **Prevent hot and cold air mixing.** When hot exhaust air mixes with your cold air, it increases the intake temperature at your equipment. This means that you may have to set the temperature even lower so that you can deliver an acceptable intake temperature to your gear. By isolating the exhaust air with a hot aisle containment system or ceiling

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returns, you can reduce the load on your cooling system and increase the power density of your racks. Because it is relatively inexpensive, compared with new infrastructure, facilities upgrades to prevent hot/cold air mixing were one of the top choices among the firms we surveyed (see Figure 12).

- Cool as little air as you have to, and deliver it directly to equipment.** Before you overhaul anything, start small — improvements like eliminating under-floor obstructions to airflow, plugging cable cutouts, and installing blanking panels in racks can improve the amount of air delivered to your racks. But not all upgrades are inexpensive. With newer servers creating hotspots within otherwise-normal facilities, many of the firms we surveyed are supplementing their cooling with new computer room AC units or localized cooling products that are installed right where additional cooling is required.
- Refresh power and cooling infrastructure.** Older, uninterruptable power supplies and power distribution units may have older, less efficient transformers that are responsible for a sizable portion of the wasted electricity in your data center. More than half of the firms we surveyed said that they were replacing these systems with newer, more efficient gear (see Figure 13). Most newer data center infrastructure is also network-connected, allowing you to collect usage statistics from a variety of energy management software. Of the firms we surveyed, 46% are now using these types of software tools to analyze how they consume power, identify waste, and improve their long-term capacity planning.

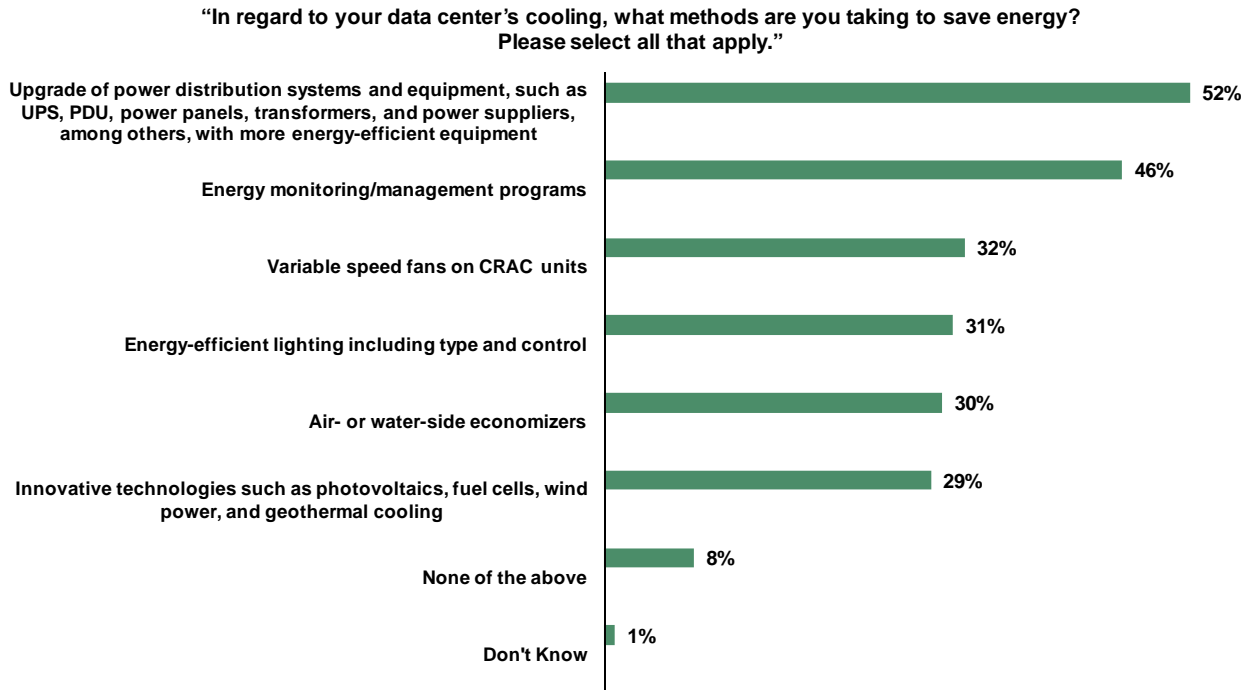
Figure 12: Closing The Air Gaps Is The Predominant Move



Base: 185 IT decision-makers (multiple responses accepted)

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Figure 13: Upgrading Power Equipment Is A Top Tactic



Base: 185 IT decision-makers (multiple responses accepted)

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Update IT Processes

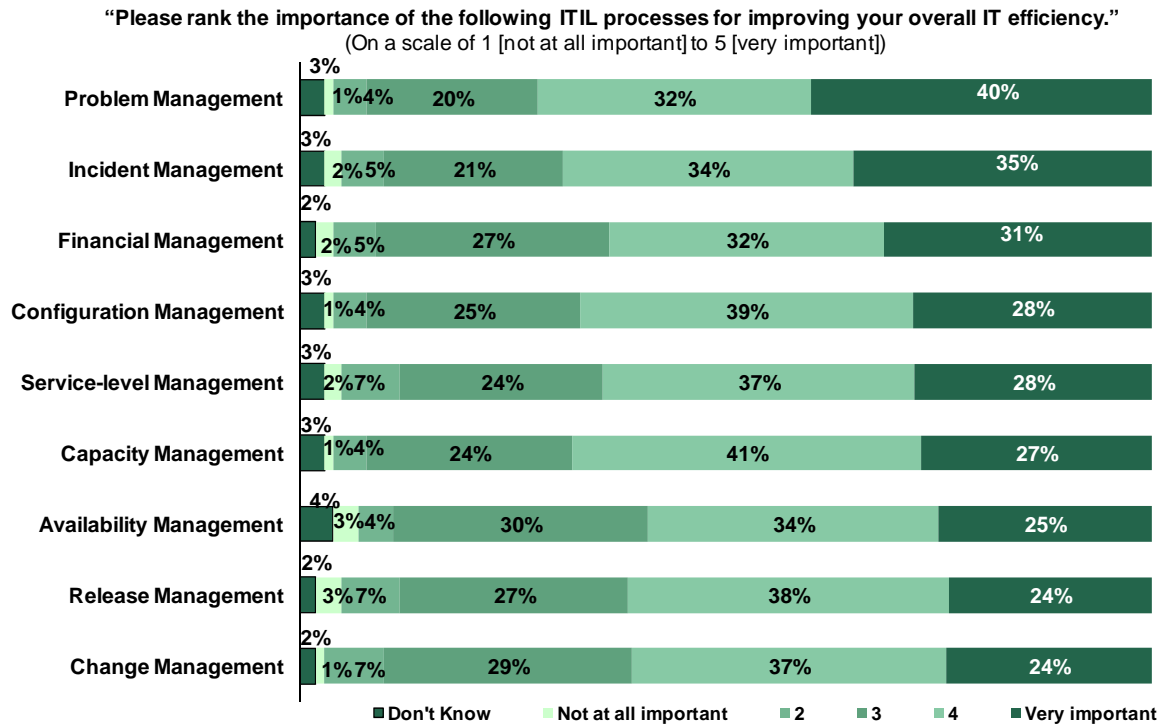
Consolidation and virtualization can help you optimize your hardware and software investments, reduce the number of systems being managed, and free up or close some data centers. However, your IT process could be largely unchanged — yet it is probably a major source of IT inefficiency. Many companies have yet to implement more formalized IT processes, while others suffer from IT processes that have too many steps and depend on manual labor to get them done. As part of optimizing your data centers, be sure to:

- Establish critical IT processes.** Not surprisingly, 73% of our interviewees have implemented at least some of the ITIL processes. Very few companies — just 9% — have managed a complete ITIL implementation. Most focus on those processes that are most critical to running reliable and efficient IT services. In particular, companies rated problem management and incident management as the most important, followed by financial management and configuration management (see Figure 14). As a result, among companies with only partial ITIL implementations, processes like incident management are likely to be one of the few “lucky” processes to be formalized.
- Investigate inefficient processes.** Although it can enable more reliable IT service, some companies’ IT process has burdened them with manual steps passing through too many different people. In short, their IT process makes tasks take longer and cost more. Among the firms we surveyed, many are targeting configuration management and financial management for efficiency improvement in the coming 12 months, while many claimed to have already made improvements to their availability and capacity management processes (see Figure 15).

Five Data Center Efficiency Moves To Make Today

- Upgrade management software.** Although IT process ensures more reliable services, the added records keeping and workflow don't come for free. Many firms that implement formalized processes don't get better efficiency because of the added overhead. You can counteract this by upgrading to system management tools that integrate with your service desk software and provide more task-level automation to free up administrators' time. For example, 47% of our interviewees are using tools that automate the provisioning of VMs, while another 43% are implementing software to help with complete server life-cycle management.

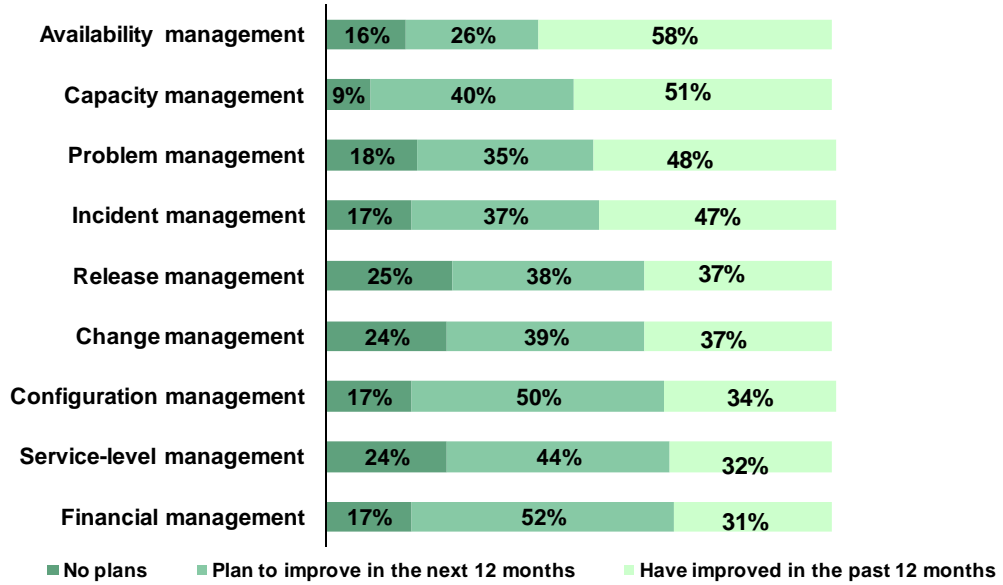
Figure 14: Top ITIL Processes To Implement For Better IT Efficiency



Base: 185 IT decision-makers
 Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Figure 15: Top Processes To Reexamine For Improvement Opportunities

“Which of the following operational processes are a focus for overall efficiency improvement?
Select one per row.”



Base: 185 IT decision-makers

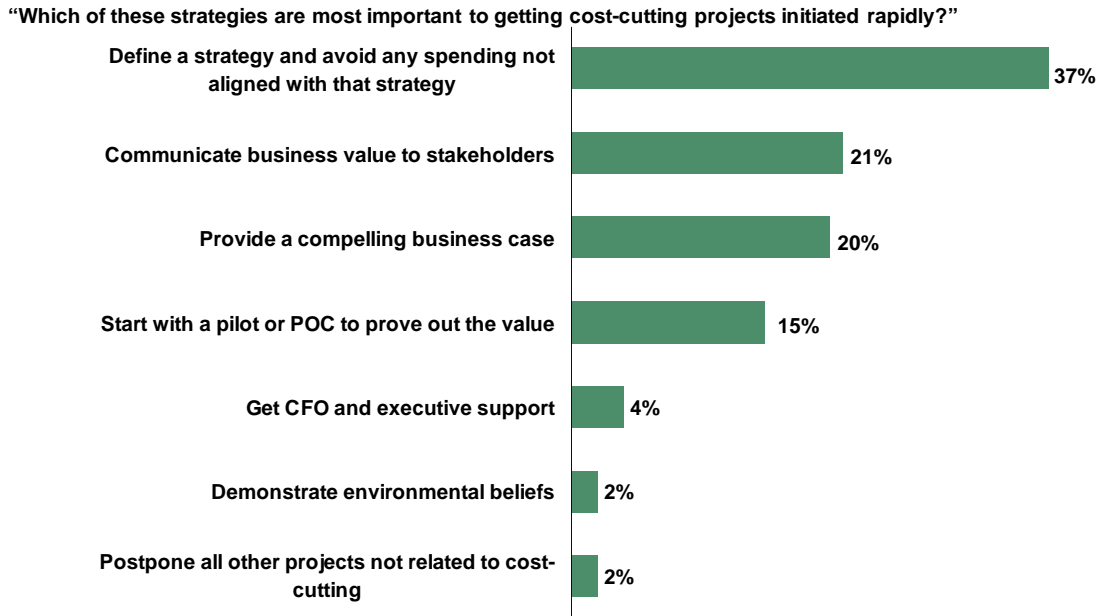
Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Best Practices In Data Center Efficiency

Forrester's in-depth survey with IT executives yielded several important observations:

- **Make IT optimization an ongoing program.** After putting together the business and technical resources to drive a successful optimization project, why disband them? In fact, many companies institutionalize their optimization efforts as an ongoing program or department that continues to look for cost-saving opportunities across departmental boundaries. By retaining the skills and best practices from prior projects, ongoing optimization programs are able to tackle more difficult consolidation projects and help drive long-term standards for technology.
- **Retrain and reskill your staff.** Optimizing your data center and IT processes should result in lower administrative overhead. However, rather than lay off staff, Forrester's prior research has found that many companies instead choose to grow without any additional hiring.¹ As a result, the main people strategy employed by our survey respondents is to retrain and/or reskill their staff (see Figure 16).
- **Increase collaboration with facilities.** There is clearly a disconnect between the importance of optimizing data center capacity and the relationship between IT and facilities. In addition to investing in power measurement tools and upgrading power and cooling infrastructure, the companies we spoke with are also working to collaborate more with their facilities groups. One barrier to better collaboration is the sharing of information between the two groups. We believe that this can be facilitated by data center infrastructure management software that links together information about the physical data center and the IT equipment that lives in it as well as real-time information from network-connected electrical equipment.
- **Stick to your strategy.** A majority of the firms we surveyed believed that one of the most important ways to get cost-cutting projects initiated rapidly was to avoid spending on anything not aligned with their strategy (see Figure 17). Surprisingly, controlling spending ranked higher than both communicating business value to stakeholders or providing a compelling business case.

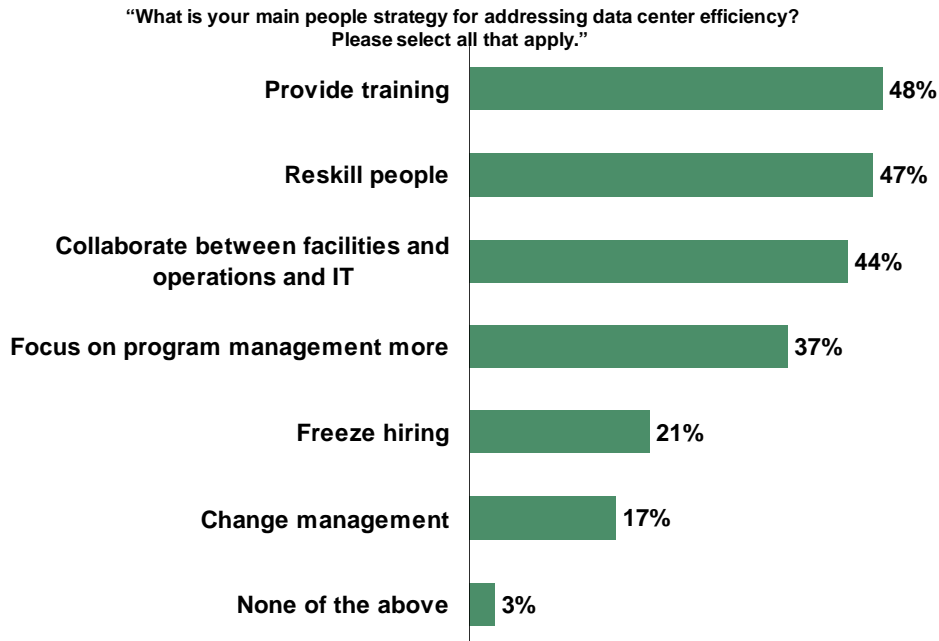
Figure 16: Limiting Spending And Linking To Business Value Are Critical



Base: 185 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Figure 17: Efficiency Requires Reskilling And Collaboration



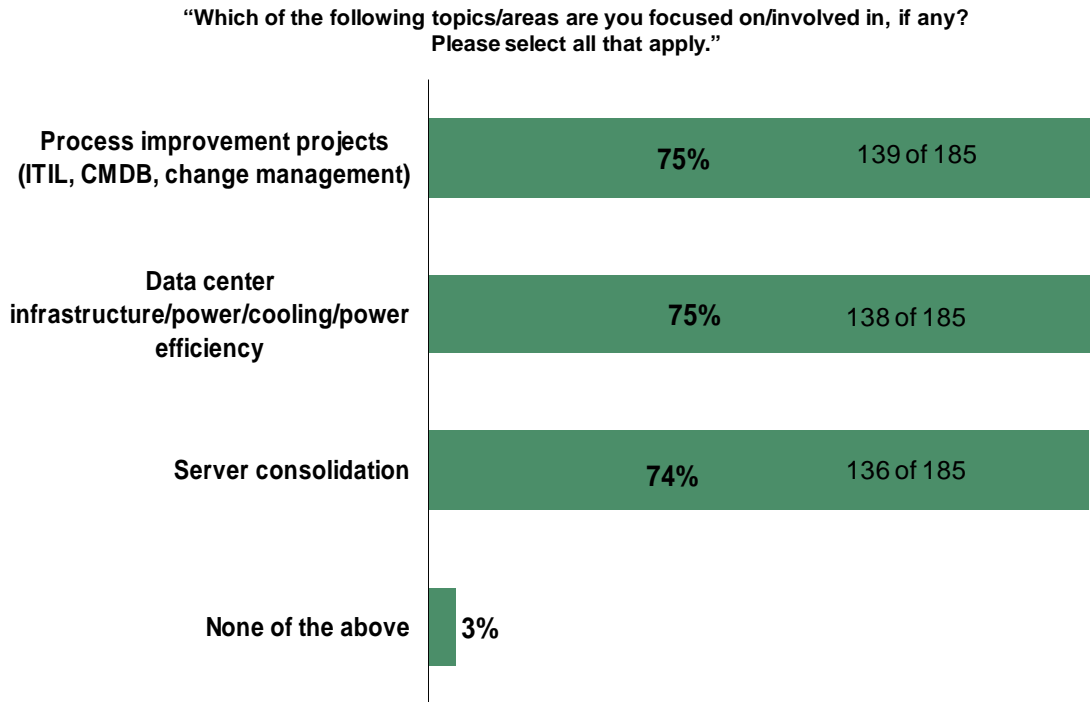
Base: 185 IT decision-makers (multiple responses accepted)

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Appendix A: Methodology

In this study, Forrester interviewed 185 organizations in the US, UK, and Australia to understand the types of data center optimization projects being performed and the relative level of benefits received from them. Responding companies were screened for initiatives in process improvement, data center efficiency, or server consolidation. Survey participants included senior-most IT executives as well as decision-makers in IT infrastructure, IT process improvement projects, facilities management, server infrastructure, and IT architecture. Questions provided to the participants asked about their level of IT process formalization and the level of benefits received from projects such as power and cooling upgrades, IT consolidation, and process automation. The study began in May 2009 and was completed in June 2009.

All Are Driving At Least Two Of These Key Initiatives



Base: 185 IT decision-makers (multiple responses accepted)
Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Appendix B: Supplemental Material

Related Forrester Research

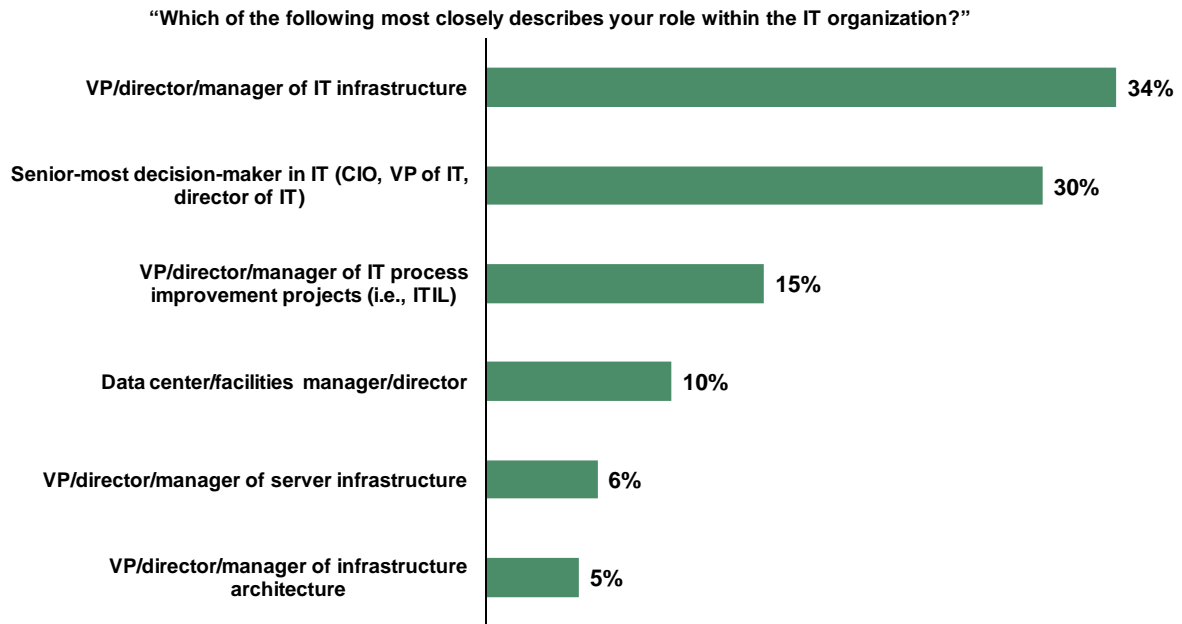
“Retrofitting Your Data Center For Better Capacity” by Galen Schreck and James Staten, October 29, 2008

“How Large Enterprises Approach IT Infrastructure Consolidation” by James Staten, December 28, 2007

“The IT Consolidation Imperative: Out Of Space, Out Of Power, Out Of Money” by James Staten, October 5, 2007

Appendix C: Demographics

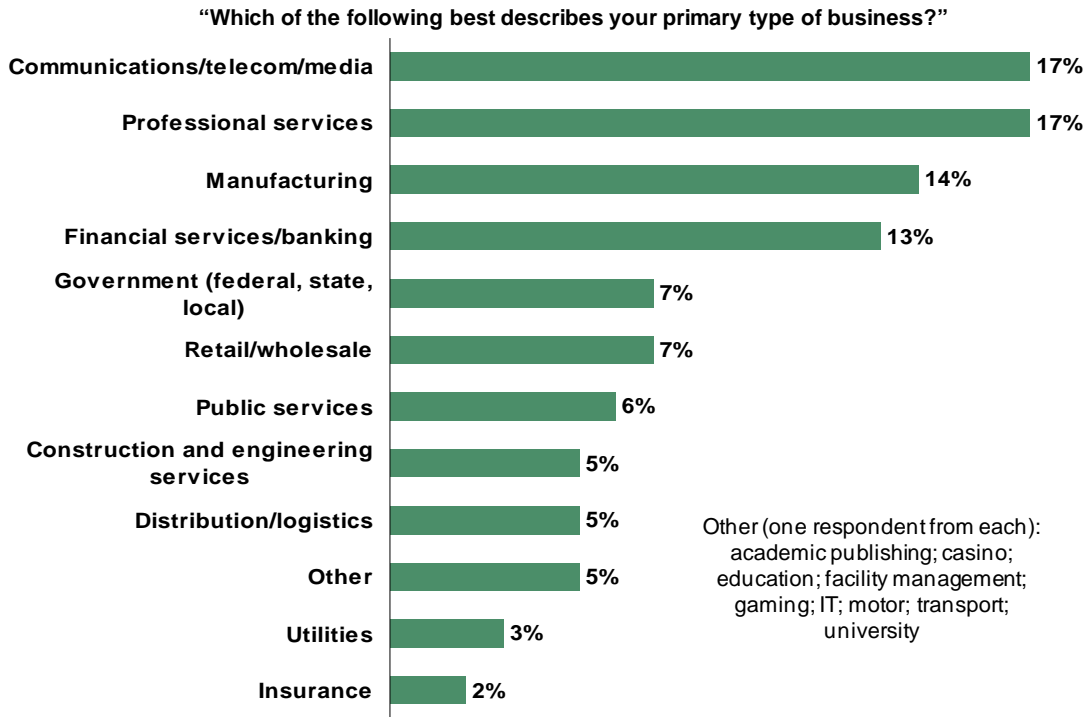
Top IT Leaders Were Surveyed



Base: All respondents

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

The Survey Spanned A Mix Of Industries Reflecting The US Business Makeup



Base: All respondents

Source: A commissioned study conducted by Forrester Consulting on behalf of HP, May 2009

Appendix D: Endnotes

¹ See the Forrester report “Best Practices: Aligning Your Infrastructure And Operations Department Around Virtualization” by Galen Schreck and Rachel A. Dines, March 20, 2009.