

A Forrester Consulting Thought Leadership Paper Commissioned By TeamQuest

Strategies To Improve IT Efficiency In 2010

Using Predictive Analysis To Do More with Less

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FORRESTER

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Executive Summary

In a recent Forrester survey, 87% of respondents in North America and 80% in Europe¹ declared that they could not run their businesses without technology. This creates a high-risk situation: The ability of an enterprise to master and manage its technological assets becomes critical for the life of the business. In March 2010, TeamQuest commissioned Forrester Consulting to evaluate the issues related to capacity management in a world where virtualization and the promise of cloud computing tend to collide with the need to improve the quality of IT services and reduce IT costs. To further explore these issues, Forrester developed a hypothesis that tested the assertion that due to the complexity of managing server consolidation and virtualization, optimum results could not be achieved with ad-hoc solutions but instead required specialized capacity management tools. One interesting element of the study involved contrasting and comparing the findings of a similar commissioned study conducted by Forrester Consulting on behalf of TeamQuest at the end of 2008 with the data collected in this survey and showing how the perception and resolution of these issues evolved in the past 14 months. As in 2008, the study started by identifying efficiency and business productivity as the key objectives for IT services, then identified infrastructure consolidation as a means to reach this objective, and finally concluded that capacity management, as a critical process in consolidation, was a fundamental building block of IT efficiency and quality of service.

A very large majority of enterprises in North America and Europe recognize that they cannot run their businesses without technology.

Key Findings

Forrester's study yielded three key findings:

- **Business workforce productivity and IT efficiency are priorities.** A large majority of respondents identified these two criteria as the most supported initiatives in their companies.
- **Infrastructure consolidation is seen as a means to achieve these goals.** Because IT needs increasingly to evolve within a finite set of resources, respondents see standardizing the infrastructure and consolidating as the best way to improve IT efficiency while maintaining the quality of service.
- **But consolidation needs a strong predictive process.** Capacity management appears to be the way to better predict the performance of consolidated infrastructures, especially when using virtualization. Firms see cloud computing as a way to alleviate the need for capacity management, but this is a misconception: Actually, cloud computing emphasizes the need for a clear and accurate capacity management process.

Business Expectations

The omnipresence of IT services in business activities means that IT organizations are increasingly considered as internal service providers, with the accompanying constraints in service quality and costs that are expected in this type of relationship. As IT budgets represent a very significant portion of an enterprise's revenue, the clearly stated objectives are: 1) to constantly improve business workforce productivity through better IT services; and 2) to be fiscally responsible and constantly decrease the cost of providing these IT services (see Figures 1 and 2).

Figure 1
2009 US IT Budgets As A Percentage Of Revenue For Enterprises

	Forrester's Business Data Services			InformationWeek 500*		Forrester and IW 500 weighted average
	Average on a cash-outlay basis	Average on an income- statement basis	n	Average IT spending	n	
Manufacturing	2.1%	2.2%	181	2.0%	183	2.0%
Primary production	1.6%	1.6%	36	0.8%	5	1.5%
Consumer products	2.0%	2.0%	39	1.5%	22	1.8%
Pharmaceuticals	3.0%	3.2%	14	3.4%	13	3.2%
Chemicals & petroleum	1.7%	1.7%	18	1.6%	11	1.7%
High-tech products	2.9%	3.1%	44	3.1%	68	3.0%
Industrial products	1.7%	1.8%	31	1.5%	64	1.6%
Retail & wholesale trade	2.6%	2.5%	28	1.7%	37	2.1%
Retail	2.8%	2.7%	26	2.3%	22	2.5%
Wholesale trade	0.4%	0.4%	2	1.0%	15	0.9%
Business services	2.4%	2.3%	27	3.0%	95	2.8%
Transportation & logistics	1.5%	1.5%	5	1.7%	33	1.7%
Professional services	3.1%	3.1%	14	4.3%	49	4.0%
Construction & engineering	1.6%	1.5%	8	1.1%	13	1.3%
Media, entertainment, & leisure	2.8%	2.9%	66	5.0%	24	3.4%
Utilities & telecommunications	2.6%	2.8%	124	2.3%	31	2.5%
Utilities	2.5%	2.8%	109	1.6%	19	2.4%
Telecommunications	3.1%	2.7%	15	3.3%	12	3.2%
Finance & insurance	4.6%	4.9%	62	5.9%	82	5.3%
Financial services	5.8%	6.2%	40	7.6%	48	6.8%
Insurance	2.6%	2.7%	22	3.4%	34	3.1%
Public sector	2.9%	2.5%	73	2.9%	50	2.9%
Healthcare	2.1%	2.1%	33	2.9%	50	2.6%
Education & social services	3.3%	2.5%	16	—	—	—
Government	3.6%	3.1%	24	—	—	—
Weighted average for all industries; totals for number of respondents	2.7%	2.8%	562	3.3%	502	3.0%

Base: 562 IT decision-makers at North American enterprises for Forrester data; 500 for InformationWeek 500 data

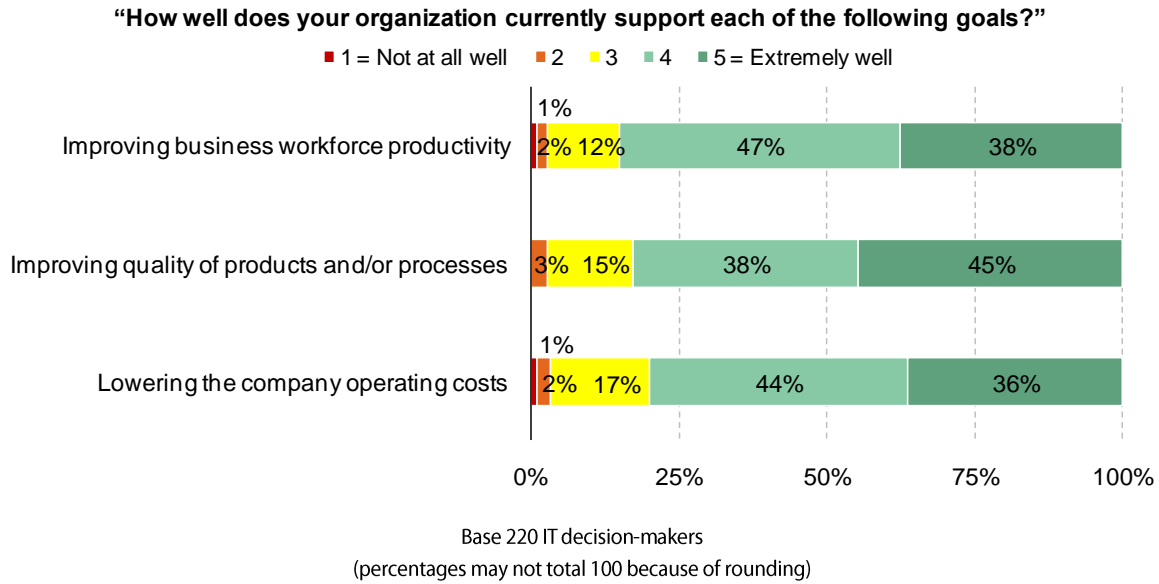
*Base: 500 US companies that are innovative users of technology, as determined by InformationWeek

Note: Forrester converted IW 500 industry groups into Forrester industry groups.

Source: Enterprise And SMB Global IT Budgets And Spending Survey, Q2 2009, Forrester Research, Inc.

*Source: "2009 InformationWeek 500" InformationWeek, September 14, 2009

Figure 2
Improving Business Workforce Productivity Is A Main Objective



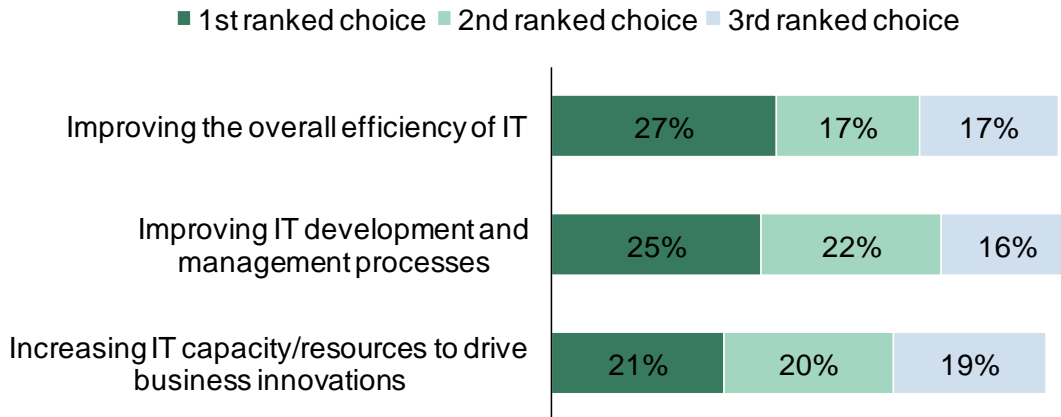
Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010

Fundamentally, IT must support enterprise goals and provide support to business productivity by delivering quality services where performance levels ensure end user productivity while contributing to the decrease of enterprise operating costs. This is clearly expressed as “improving IT efficiency” (see Figure 3).

Going further down into the definition of IT efficiency, we can see that the criteria defined in the Q4 2008 survey have not changed. There is a stronger accent on constant improvement of quality and best effort to deliver this quality of services, but overall the emphasis is even stronger on cutting costs, which progressed by 11% compared to 2008. Obviously the economic climate is still a strong catalyst for more efficient IT (see Figure 4).

Figure 3
 Improving The Efficiency Of IT Is The Main Corporate Objective

“Which of the following initiatives are likely to be your IT organization’s major business - or corporate-related themes in 2010?”

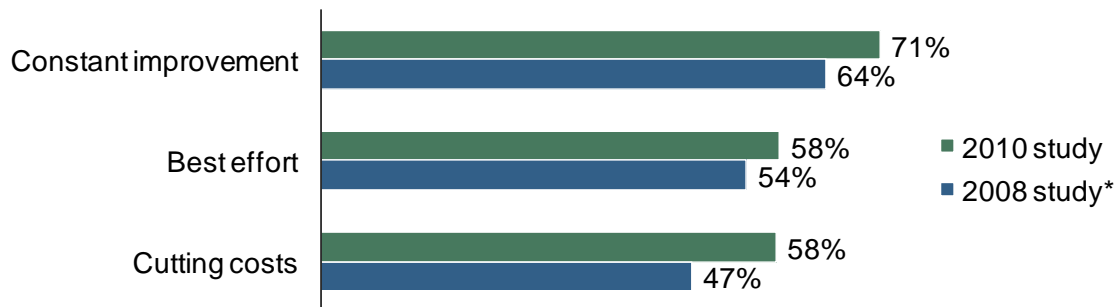


Base 220 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010

Figure 4
 Emphasis On Cutting Costs Is Stronger In 2010 Than In 2008

**“What are the key criteria by which your organization defines an efficient IT organization?”
 (Select all that apply.)**



Base 220 IT decision-makers

*Base 226 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010

*Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, November 2008

Improving IT Efficiency

One of the major issues in trying to improve IT efficiency is the fact that multiple improvements to the existing IT organization and infrastructure have to be conducted while the technology capabilities continue to grow at an exponential rate. This leads to an extremely complex situation:

- **Moore's Law of Hardware.**² Gordon Moore wrote an article in *Electronics* in 1965 in which he predicted that the density of transistors on a chip will double every year. In 1975, he revised the prediction to "double every two years." Because of the clear link between density and speed, this became "double the computing speed every 18 months." This leads to an exponential decrease in component cost and an exponential increase in system capacity.
- **Watts Humphrey's Law of Software.**³ Drawing a parallel with Moore's Law, Watts Humphrey stated that the size of software doubles every two years. This is confirmed by looking at the size of different operating systems.⁴
- **Wu-chun Feng's Law of Power Consumption.**⁵ In a 2003 article on supercomputing, Wu-chun Feng stated that in 1991 a supercomputer occupied about 600 square feet (SF) and required 500 kilowatts (kW) of power. In 2003, the new generation of supercomputer ultimately occupied more than 21,000 SF and required 3,000 kW. This shows that processing power increased dramatically (by a factor of 2,000) while the efficiency of the system was far from being on par, since the performance per watt increased only 300-fold. This exemplifies one of the critical consequences of Moore's Law, that an increase in computing power has a corollary effect on power consumption.
- **Nielsen's Law of Bandwidth.**⁶ This describes a similar phenomenon for Internet bandwidth, which doubles every two years.

All these indicators point in the same direction: an exponential growth of technology capabilities which translates into an exponential growth in IT service usage. It is now possible to provide an IT service for any task, even the most menial one, at a price that benefits business productivity.

The major challenge for an IT organization is to effectively manage this complexity. As an immense amount of data is collected from monitoring infrastructures and applications; it has now reached a point where it is beyond the correlating capabilities of human beings. To be effectively used, the data needs to be normalized and analyzed by tools before it can be used by IT administrators and engineers. A few years ago performance and quality of service issues were simply dealt with by adding capacity since hardware was getting cheaper and cheaper with time. But today's issue is no longer whether to manage the quality of service by "throwing hardware at a problem." We now need to optimize the data center within the limits of manageable complexity and of resources such as power consumption while ensuring quality of service. As technology complexity taxes the limits of what individuals can manage, we can no longer simply "throw people at the problem." Facing the limitations of what is possible with the available resources, many IT organizations have decided to tackle the issue at the root and are turning toward standardization and consolidation of their infrastructure to improve efficiency. They have also decided to improve their predictive analysis of the capacities needed throughout the IT application life cycle (see Figure 5).

This trend toward standardization and consolidation of the infrastructure is effectively the better approach to reduce IT operation costs: Reducing the number of servers means less administration. Although given the legacy systems that are present in all large IT organizations, the consolidation may be accomplished through different methods according to

the type of computing platform, the major objective is to reduce the infrastructure to a more manageable set of computing platforms that will be more efficient in terms of administration and resource consumption (see Figure 6).

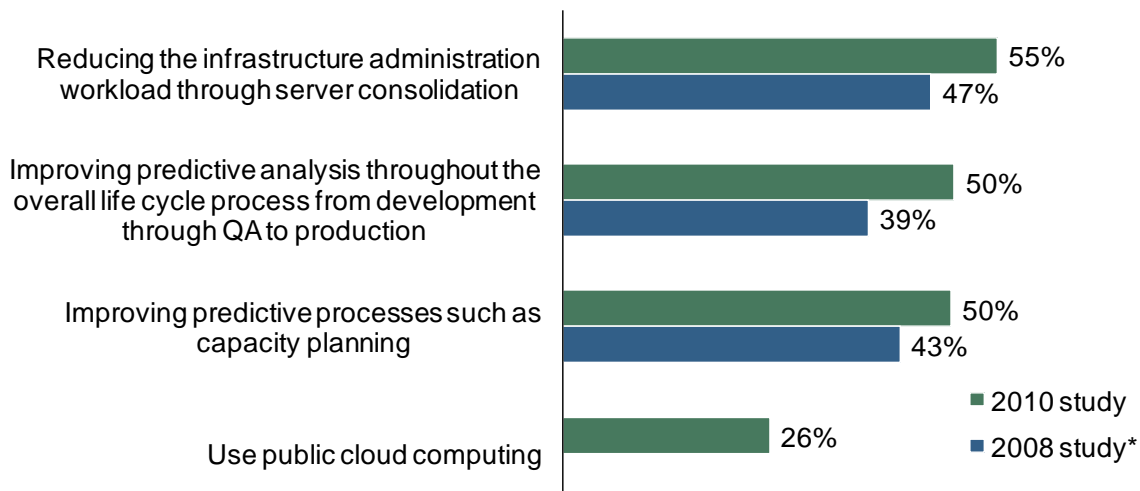
Along with server consolidation and virtualization, cloud computing is listed as a possible means to improve IT efficiency. The most favored type of cloud computing seems to be the “private cloud,” essentially based on the virtualization of x86-based machines, but there is a definite trend toward planning the use of public clouds or software-as-a-service (SaaS), as we see in Figure 7.

The clear perception is that cloud computing is a “magic bullet” that will remove all the potential costs associated with infrastructures and administration. Clearly, cost and reduction of complexity are the motivating factors behind this trend toward the different forms of clouds (see Figure 8).

Figure 5

Areas Of Improvement For A More Efficient IT

“What areas of your organization should be improved to make IT more efficient?” (Select all that apply.)



Base: 220 IT decision-makers

*Base: 226 IT decision-makers

Note: The 2008 study did not ask about cloud computing.

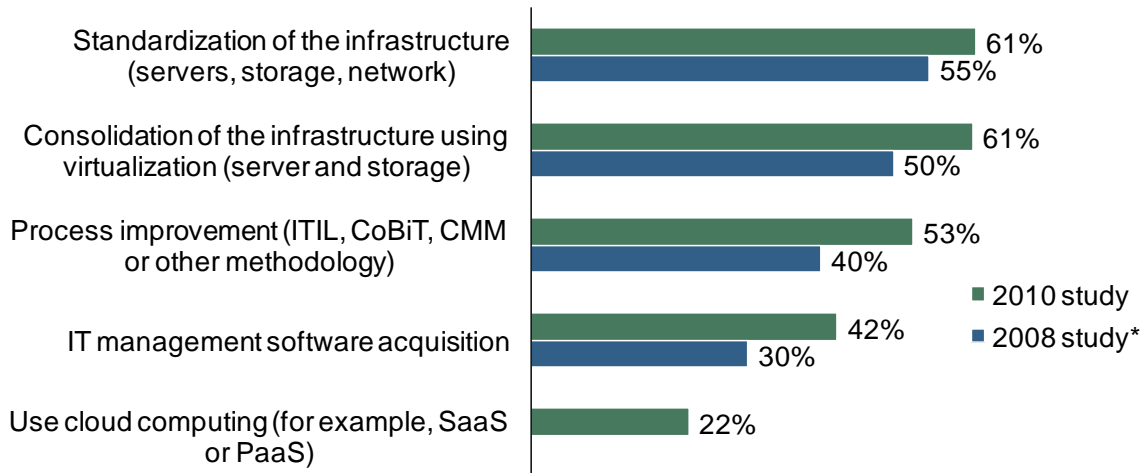
Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010

*Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, November 2008

Figure 6

Standardization And Consolidation Are The Most Popular Measures To Increase IT Efficiency

“What are the measures your organization is taking to improve IT efficiency?” (Select all that apply.)



Base: 220 IT decision-makers

*Base: 226 IT decision-makers

Note: The 2008 study did not ask about cloud computing.

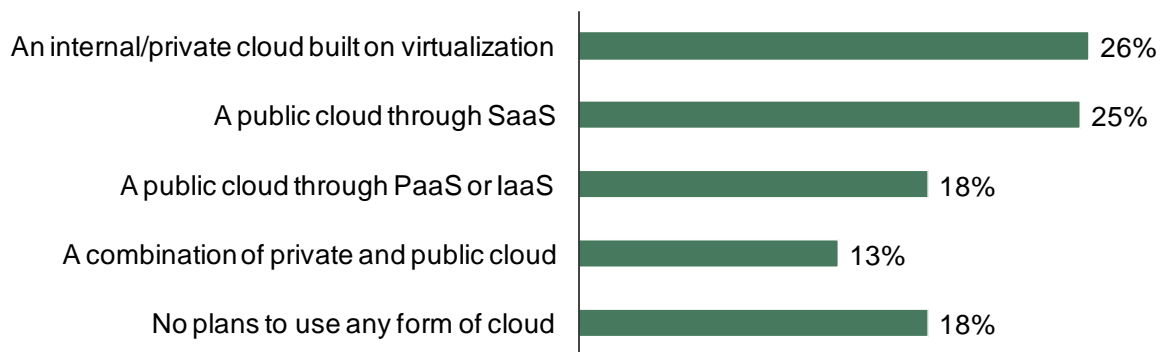
Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010

*Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, November 2008

Figure 7

Use Of The Different Forms Of Cloud Computing Within The Next 12 Months

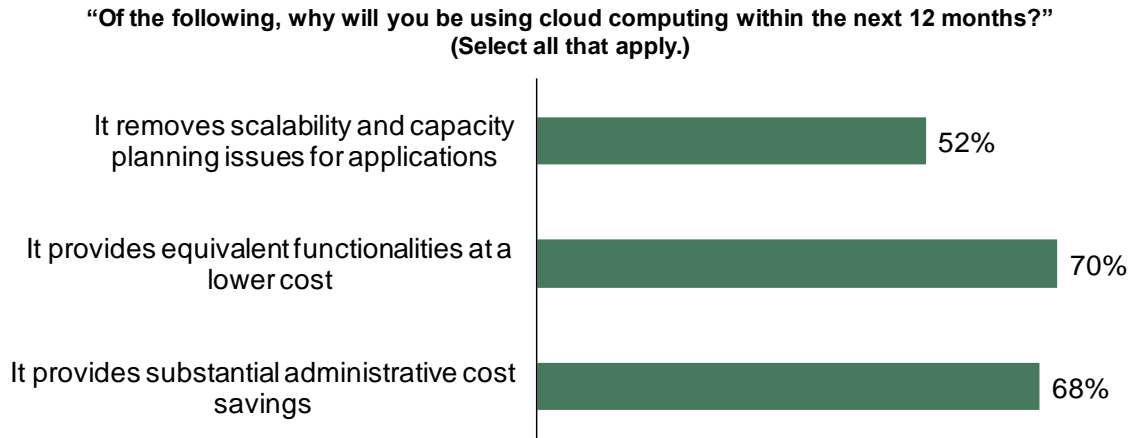
“Which, if any, of the following is your organization planning to use within the next 12 months?”



Base: 220 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010

Figure 8
Cost Is The Major Factor In The Cloud Computing Trends



Base: 124 IT decision-makers who plan to use cloud computing in the next 12 months

Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010

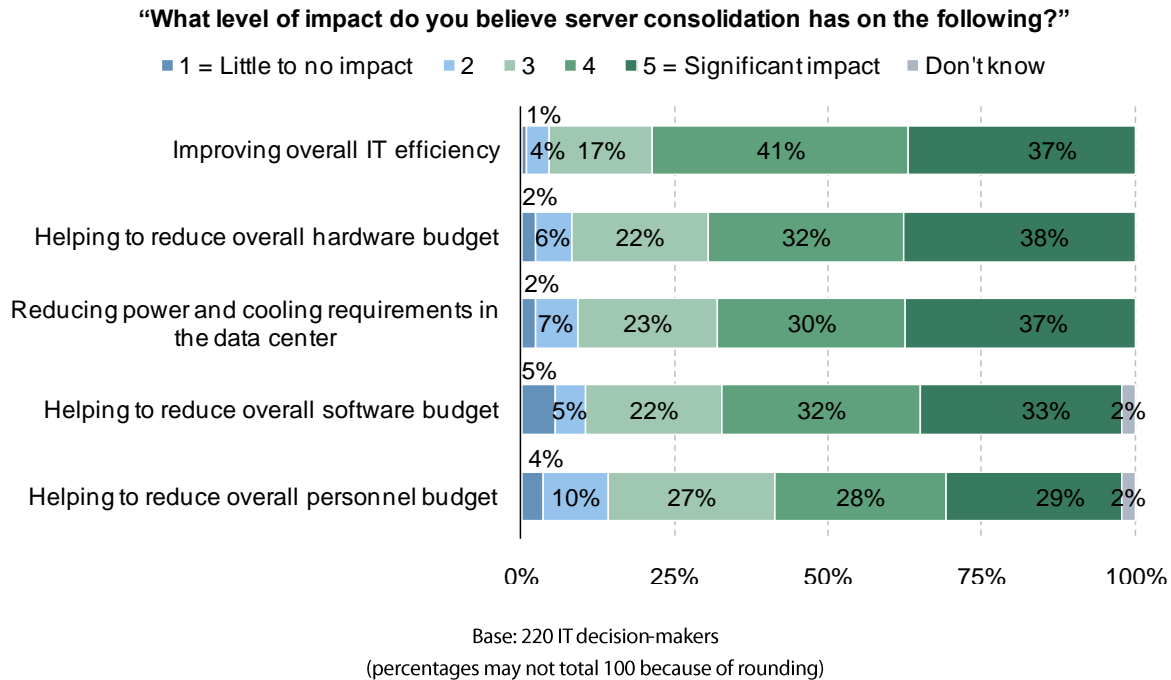
Benefits And Challenges of Virtualization And Cloud Computing

Server consolidation adoption has clearly improved and reached a level of maturity that is starting to show benefits as shown in Figure 9.

Compared to Q4 2008, virtualization as a basis for server consolidation has also increased significantly. More importantly, however, it has significantly increased in critical applications, as shown in Figure 10.

However, because virtualization deployments were actually higher than a year ago, the position of virtualization skeptics was more solidly entrenched. Even though there were fewer respondents not adopting virtualization (24 in 2010 versus 42 in 2008), the increased maturity in understanding the technology has clearly provided more informed answers than a year ago. Quite obviously, the added complexity of virtualization was a strong argument against it, as shown in Figure 11.

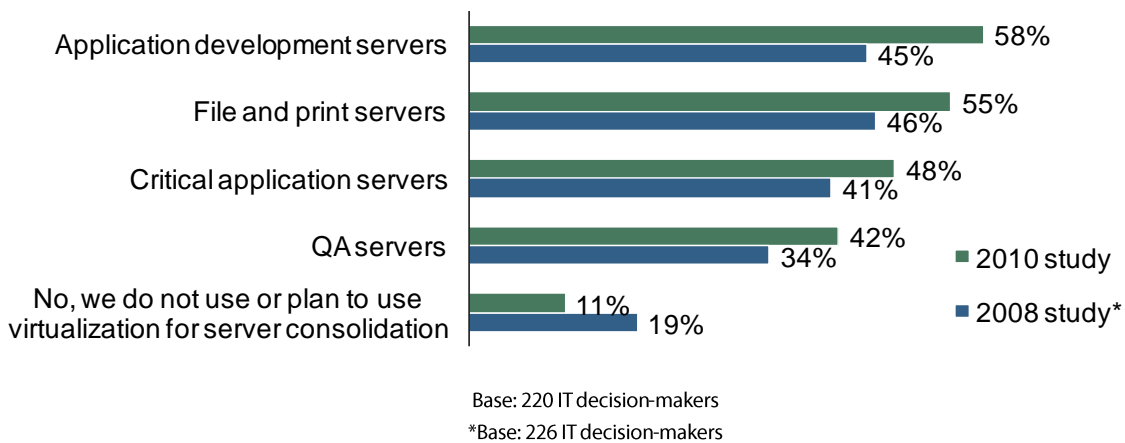
Figure 9
 Overall IT Efficiency Is The Top Benefit Of Server Consolidation



Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010

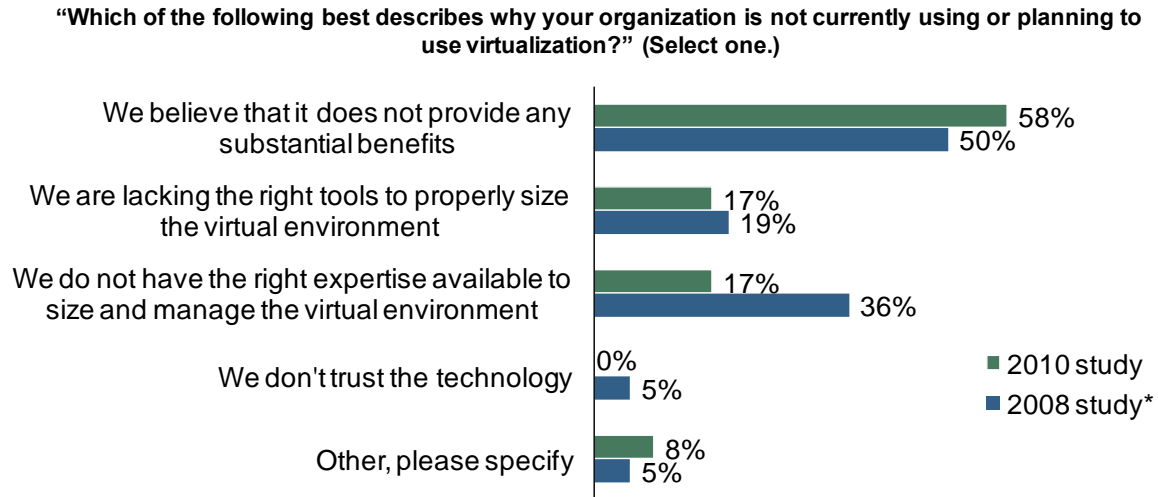
Figure 10
 Virtualization Adoption Has Significantly Increased Since Q4 2008

**“Is your organization using or planning to use virtualization for server consolidation for any of the following?”
 (Select all that apply.)**



Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010
 *Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, November 2008

Figure 11
 Reasons For Not Adopting Virtualization



Base: 24 IT decision-makers who do not use virtualization
 *Base: 42 IT decision-makers who do not use virtualization

Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010
 *Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, November 2008

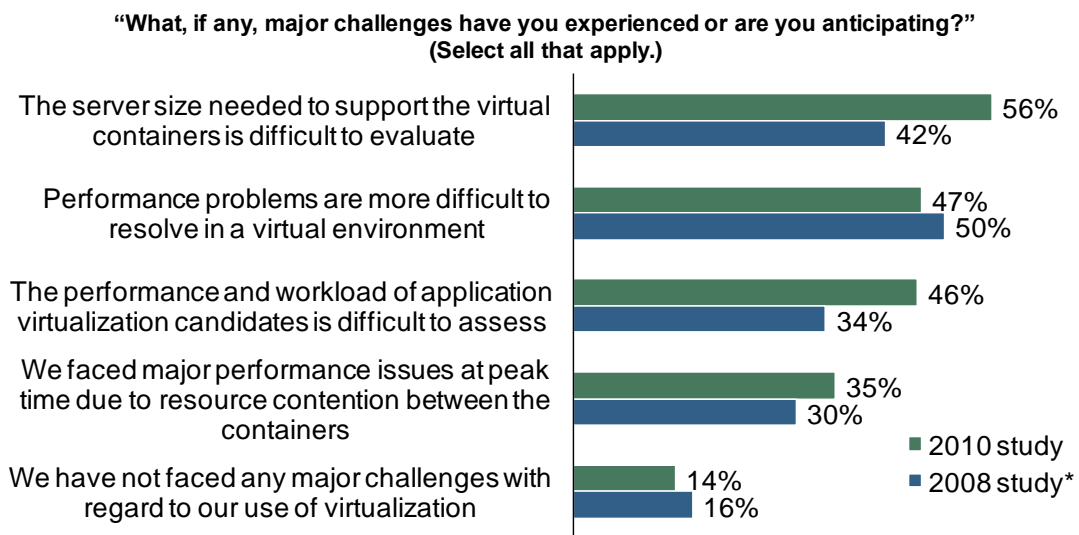
In terms of challenges posed by virtualization, there has been a shift in the major issues identified. It now appears that the most challenging issue is in the initial sizing and placement of virtual containers. On the other hand, the resolution of performance issues in production appears to be less of an anticipated challenge than it was a year ago. This is definitely the result of experience in the use of predictive techniques that were clearly not adapted to the new constraints of virtualization. While typical capacity management techniques of the past were essentially based on a snapshot of resource usage at peak time, this is clearly not working in evaluating the placement of virtual machines within a physical machine.

Capacity planning used to be based on a relatively “static” set of tasks: The main goal was to study the resource behavior under load and predict the resources needed to cope with the peak workload. The fundamental reason for this static approach is to be found in the way resources were provisioned: Because it was a matter of physical hardware that had to be sourced from outside vendors, delays would be the norm due to the time required to order, ship, and configure the new resources. Forecasting is therefore based on a snapshot of resource usage representing the worst case scenario. The availability of cheaper servers let many organizations deploy one application per server, reducing the need for capacity planning and its replacement by the “let’s throw hardware at the problem” approach to performance management.

Now that economic limitations — and soon physical limitations such as power and floor space — have entered the equation, server consolidation becomes an exercise in which multiple workloads need to be compounded to determine the final workload and the future system’s dimensions. This is where application profiles or histograms of the way an application consumes resources over time become a key element of the decision. In a typical one-to-one scheme, where an application runs directly on a physical server, histograms were mostly used to determine a worst case scenario and a snapshot of the resource requirements. In a consolidation project, however, what complicates the issue are the potential

conflicts of several applications vying for the same resource: Because this resource contention may occur at any time, especially with online transaction applications, the dimensioning of resource requirement has to be conducted historically to ensure that resource contention is kept at a minimum at any time during production hours. The dynamic nature of virtualization exacerbates the problem's complexity. The possibility to dynamically alter the initial resource allocation requires an even more precise view of application performance behavior to avoid the creation of contention for physical resources and unexpected performance issues.

Figure 12
 The Challenges Of Server Consolidation And Virtualization

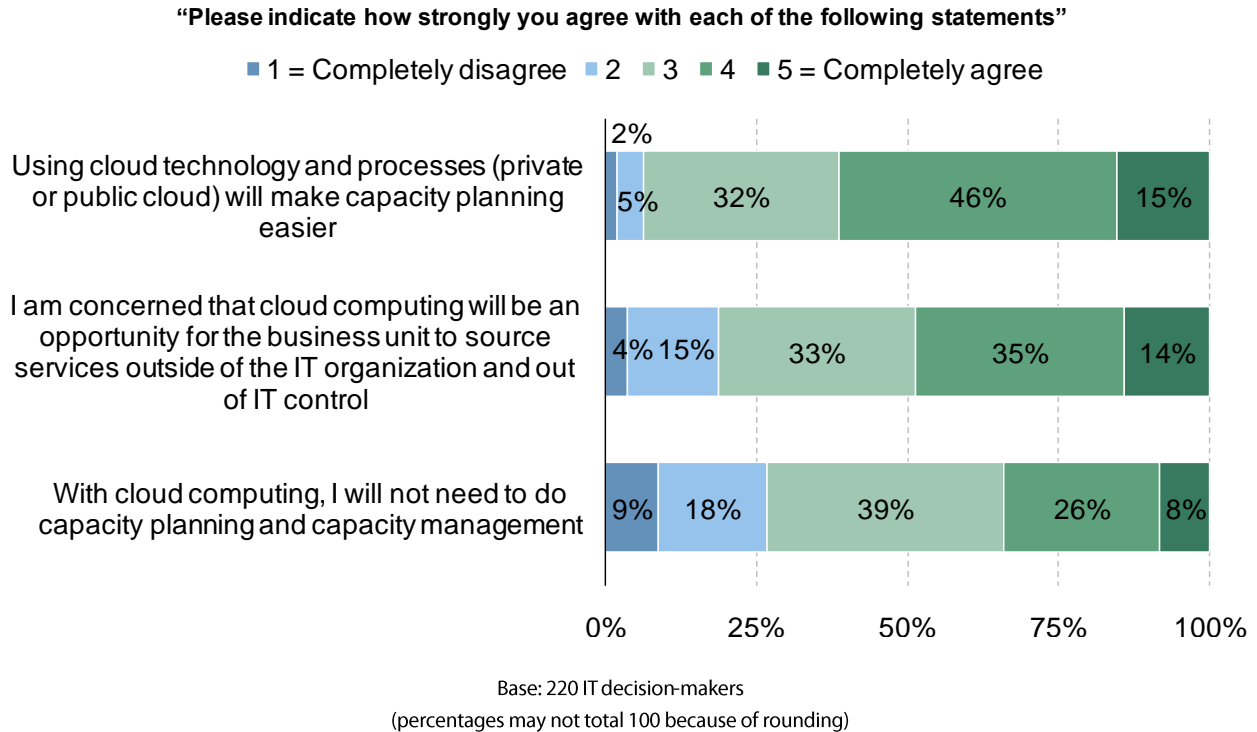


Base: 190 IT decision-makers who currently use virtualization
 *Base: 176 IT decision-makers who currently use virtualization

Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010
 *Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, November 2008

We see clearly that the continuous collection of data required to estimate workloads and combine them on a physical machine is in fact a challenging issue. The increased adoption of virtualization makes this more apparent in 2010 than it was in Q4 2008. Cloud computing is often seen as a “cure-all” way to alleviate the capacity management issue. Because resources are allocated on demand, it seems that an accurate predictive analysis is not required (34%) or the process will be simplified (61%), as shown in Figure 13.

Figure 13
 The Perception Of Cloud Computing Impact



Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010

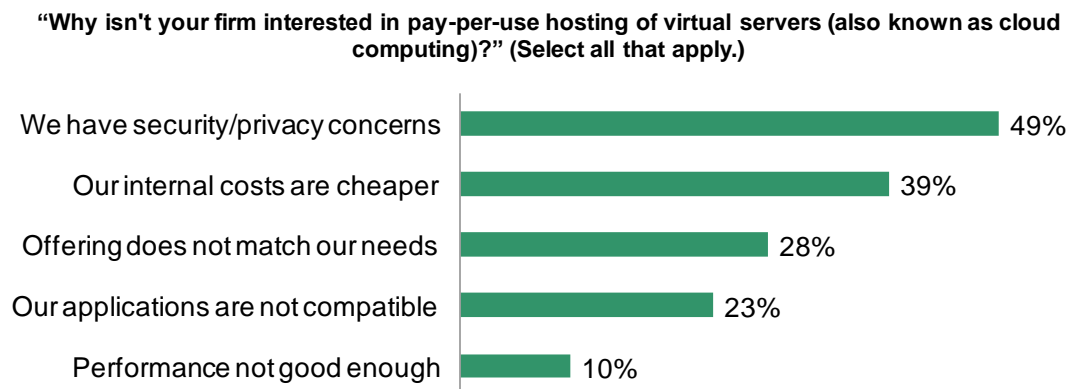
Of the three major categories of cloud computing — software-as-a-service (SaaS), platform-as-a-service (PaaS), and infrastructure-as-a-service (IaaS) — IaaS is the most generic technically and therefore the most adaptable to meet a wide variety of business and application scenarios. Whereas SaaS is, by definition, a particular application, and PaaS provides diverse development platforms that may be better for one kind of application than another, IaaS provides generic computing, storage, and network capacity on which almost any kind of application can be deployed, with the caveat that it should be ready for the cloud environment (although the IaaS porting effort may be substantial for some applications). IaaS vendors charge based on multiple vectors of consumption (e.g., processing, memory, storage, and bandwidth) and may have multiple pricing models. This means that forecasting the actual cost of IaaS requires more intricate financial models than does forecasting the cost of traditional hosted or on-premise environments — or it requires a different approach altogether that aims to correlate increases in actual cost with increases in business activity and value. Even when the basic technologies are the same — for example, same operating system, same database management system (DBMS), etc. — variations in the topology, operations, management, and cost models of an IaaS environment can affect application design and security. Effects may be subtle, such as the need to change the way IP addresses are allocated and configured, but they can also be large, such as having to redesign data distribution or backup strategies to reduce the cost of moving data in and out of the IaaS provider's environment. These considerations will vary from one IaaS offering to the next, which means that an application that is cost-effective in one IaaS environment may not be cost-effective in another. Thus, an IaaS-enabled infrastructure strategy must have a corollary IaaS-enabled application architecture strategy to address such design considerations. There are also technical

differences in how one customer's data and apps are segregated from those of other customers in IaaS providers' data centers. To properly assess the tradeoffs between IaaS, on-premise servers, and traditional hosting and answer the question "When, where, and how should my organization use IaaS?" a broad computing infrastructure strategy is needed that combines technical considerations with financial analysis and the parameters of each business scenario. This strategy will require an expanded set of analysis criteria, more intricate decision trees, and/or clearly defined usage patterns.

A Forrester survey of enterprises in North America and Europe shows that cloud computing has a number of limitations for some IT organizations (see Figure 14), and that some of the benefits listed in Figure 7 may not be so easy to capture. A number of IT organizations believe that, in fact, their internal costs will be lower than those of solutions such as IaaS or SaaS.

Figure 14

Security Is A Top Concern When Thinking About Cloud Computing



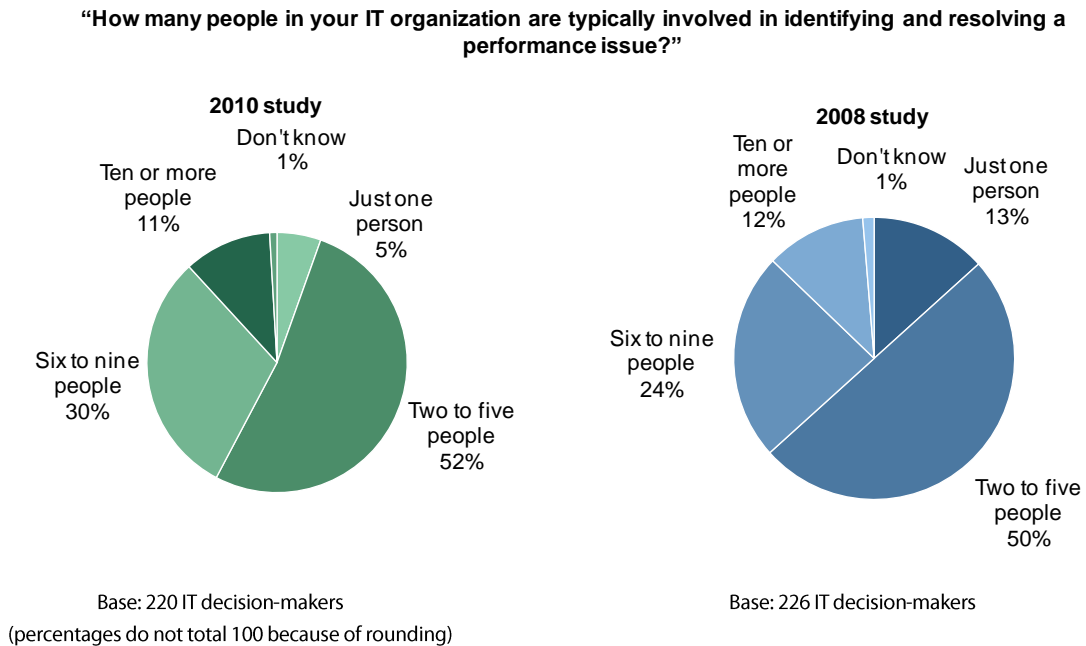
Base: 275 enterprise-level IT decision-makers

Source: Forrester Research, Enterprise And SMB Hardware Survey, North America And Europe, Q3 2009

So, the conception that cloud computing will actually reduce the need for predictive analysis or capacity management is actually wrong. Whether using SaaS or IaaS, there is a need for a strong requirements analysis and preparation that would sometimes nullify the perceived benefits. In many cases, security, governance, or technology concerns will simply put cloud computing out of contention. In any case, at best, it will barely improve the capacity management issue, and it could greatly complicate the process.

The lack of predictive analysis is, however, impacting the capacity of enterprises to resolve problems quickly, as shown in Figure 15.

Figure 15
Resources Allocated To Performance Issue Resolution



Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010
Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, November 2008

From this data, we see that, in fact, fewer problems are resolved by one person, which tends to indicate that problems are now more complex than before.

To summarize:

- A majority of respondents see server standardization and consolidation as the best way to improve IT efficiency.
- But there is an increasing challenge in terms of capacity management when it comes to using virtualization. Placement and sizing of the virtual resources are more challenging than expected a year ago.
- Cloud computing is seen as a potential solution to alleviate the need for capacity management, but this is a misconception: In fact, pricing and performance issues are difficult to assess in this new environment.
- Resources needed to correct performance issues seem to have increased over the last year, most probably due to increased adoption of virtualization, which presented more challenges than anticipated.

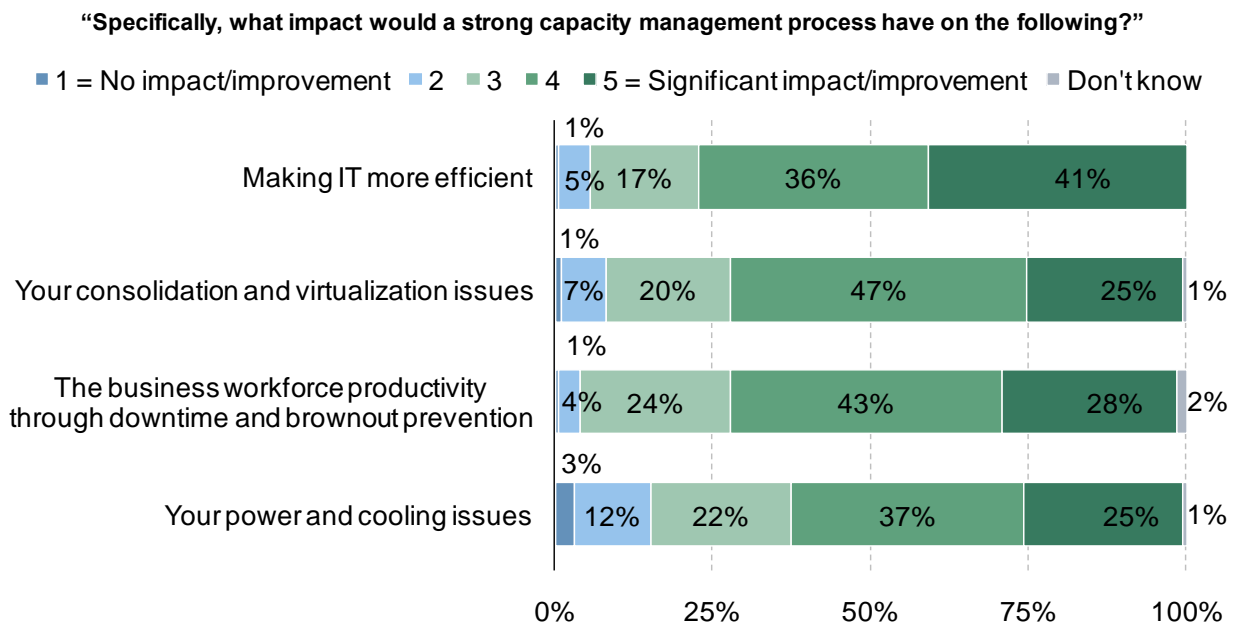
Solution And Anticipated Benefits

Capacity management is explicitly described in ITIL V2 and fits clearly the definition of IT efficiency:

“The Process responsible for ensuring that the Capacity of IT Services and the IT Infrastructure is able to deliver agreed Service Level Targets in a Cost Effective and timely manner. Capacity Management considers all Resources required to deliver the IT Service, and plans for short, medium and long term Business Requirements.”

In fact, most of our respondents agree with this definition, as seen in Figure 16.

Figure 16
 Capacity Management Is Clearly The Solution

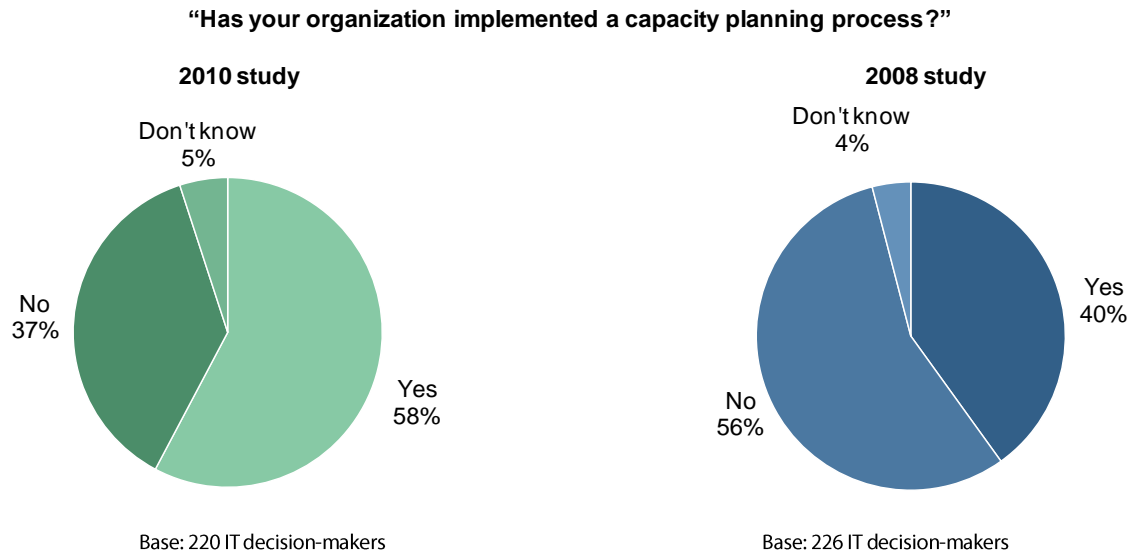


Base: 198 IT decision-makers who believe capacity management has a significant impact on reducing performance issues
 (percentages may not total 100 because of rounding)

Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010

This renewed trust in capacity management is obvious when looking at the number of companies that have implemented such a process. Figure 17 shows that the percentage of companies with a capacity management process has increased to 58% — almost a 50% increase from Q4 2008, when the percentage was 40%.

Figure 17More Respondents Have Implemented A Capacity Management Process



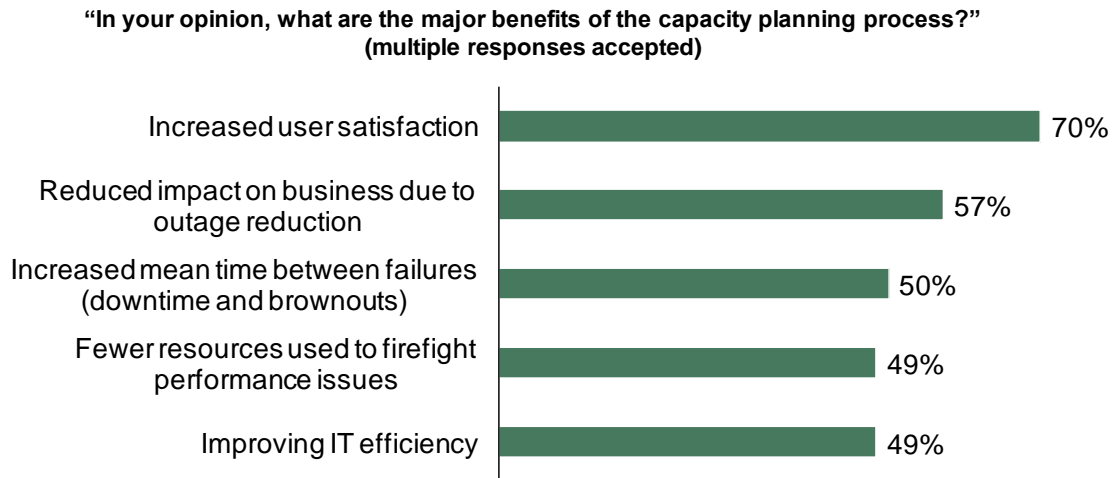
Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010

Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, November 2008

The benefits cited by the companies using a capacity management process are clear and unequivocal (see Figure 18):

- **Increase in end user satisfaction.** This goes directly to the goal of better business workforce productivity. Numerous studies have shown that response time is a key criterion in this regard.
- **Reduced impact on business due to outage reduction.** The reduction of outages goes directly to the business bottom line.
- **Fewer resources used to firefight performance issues.** This goes directly to IT costs and unscheduled activities of IT resources.

Figure 18
Companies With A Capacity Planning Process Find Increased User Satisfaction As The Top Benefit



Base: 127 IT decision-makers using a capacity planning process

Source: A commissioned study conducted by Forrester Consulting on behalf of TeamQuest, February 2010

However, the majority of respondents using a capacity management process seem to favor statistical tools over specialized capacity management tools. Although this is true when we look at the typical snapshot capacity tool, we believe that, in the future, this trend will be reversed. The issue of virtual container placement is essentially a matter of adequate resources and contention between virtualized applications vying for common resources at the physical level. In a virtualized environment, the understanding of how physical resources are used by the virtual components is of prime importance for performance, and this cannot be accomplished without: 1) a clear history of how each application consume resources; 2) a very fine granularity when it comes to capturing this resource usage; and 3) means to conduct “what if” scenarios to understand how application virtualization candidates can be combined. Conducting “what if” scenarios is not a simple matter of using a spreadsheet to conduct a linear regression of some key numbers, or even taking into account that, statistically, the performance impact of workload on resources varies linearly until a point where it becomes exponential. Understanding how resource contention affects performance requires an in-depth knowledge of system behavior and resource usage queuing that is impossible to recreate in ad hoc or simple statistical analysis: It takes a professional-grade solution. Throwing hardware at the problem will not resolve this issue either, as there is a need to understand which resources are in contention before deciding on an upgrade.

Cloud computing, as we have seen, does not alleviate the need for capacity management. Since resources are allocated as a function of the user request, a comprehensive understanding of the capacities needed is a prerequisite for using clouds efficiently. In the case of SaaS, a need to understand who is using the application and the number of subscriptions to acquire requires also a clear understanding of workload and application usage. Instead of removing the need for capacity planning, the cloud solutions are actually accentuating the requirements for a precise and accurate predictive analysis. The number of variables to take into account has actually increased, which makes the capacity management process more complex than it would have been be in a completely controlled environment.

KEY RECOMMENDATIONS

The consequences of entering server consolidation and virtualization without prior knowledge of application workloads and resource usage will translate into performance issues that will cost IT time to resolve and, more importantly, will also affect the business workforce productivity. The survey respondents found that preventing this problem from happening is a far better economic proposition, and this is shown by the spectacular increase in capacity management adoption (close to 50% in 15 months). Our recommendation is to:

- **Adopt a capacity management process.** This process needs to be adapted to the problem at hand. If aimed at server consolidation and virtualization, it has to be significantly different from a traditional, static capacity management process.
- **Use tools that are adapted.** There is still a lot of misconception about the best tools for capacity management. We believe that the requirements for a dynamic infrastructure such as virtualization require specialized tools that are beyond statistics and ad hoc homegrown methods. Specialized tools adapted for virtualization are the way to go.
- **Cloud computing does not remove the need for a sound process.** As discussed in this paper, cloud computing brings forward some constraints that actually emphasize the need for capacity management. Even if all applications are “cloud ready,” you must anticipate the capacity requirements in the cloud or face dismal performance at the end-user level.

Appendix A: Methodology and Demographics

In February 2010, Forrester Consulting conducted an online survey of 220 global IT decision-makers to understand how companies currently view their IT organization, including IT initiatives and processes. Specifically, we looked to gain insight into how companies are working to increase their IT efficiency, and understand companies' current use of and pain points around server consolidation and virtualization. We also examined how organizations currently resolve performance issues and looked to highlight their opinions around the benefits and barriers to capacity planning. In this survey:

- 45% of respondents were headquartered in the US. The other 55% were equally distributed across Germany, France, the United Kingdom, and Scandanavia.
- With respect to company size, 16% came from small companies with less than 100 employees, 32% came from medium-sized companies with between 100 to 999 employees, 25% came from large companies with 1,000 to 4,999 employees, 16% came from very large companies with 5,000 to 19,999 employees, and 11% came from global companies with 20,000 or more employees.
- Respondents came from a variety of industries. Special attention was paid to business and professional services, financial services, and insurance.
- All respondents held IT positions: 50% were the senior-most IT decision-makers in the company, 32% were executives within IT, and 18% were managers or directors within IT reporting to executives in IT. Respondents held a variety of titles, such as CIO, CTO, VP/director/manager of operations, director/VP of application development, or IT architect.

Appendix B: Supplemental Material

Related Forrester Research

"Taking The Fog Out Of Cloud Computing: Infrastructure-As-A-Service," Forrester Research, Inc., March 11, 2010

"Vendors Beware: Virtualization, PaaS, And SaaS Are Changing The Capacity Management Tools Market," Forrester Research, Inc., November 10, 2009

"Capacity Management in a Virtual World," Forrester Research, Inc., April 17, 2009

Appendix C: Endnotes

¹ Source: Enterprise And SMB Software Survey, North America And Europe, Q4 2009, Forrester Research, Inc.

² See ftp://download.intel.com/museum/Moores_Law/Video-Transcripts/Excepts_A_Conversation_with_Gordon_Moore.pdf.

³ See The Watts New? Collection: Columns by the SEI's Watts Humphrey (<http://www.sei.cmu.edu/library/abstracts/newsletters/wattsnewcompiled.cfm?DCSext.abstractsource=RelatedLinks>).

⁴ See “Market Overview: The IT Management Software Market in 2009,” Forrester Research, Inc., March 13, 2009.

⁵ Source: Wu-chun Feng, *Making a Case for Efficient Supercomputing*, ACM Queue (<http://queue.acm.org/detail.cfm?id=957772>).

⁶ Source: Jakob Nielsen, *Nielsen's Law of Internet Bandwidth*, useit.com (<http://www.useit.com/alertbox/980405.html>).