



June 27, 2011

Build Or Buy? The Economics Of Data Center Facilities

by Rachel A. Dines

for Infrastructure & Operations Professionals



June 27, 2011

Build Or Buy? The Economics Of Data Center Facilities

A Total Economic Impact™ Analysis Uncovers That For Most Companies Leasing A Data Center Is More Economical Than Building One

by **Rachel A. Dines**

with Doug Washburn, Galen Schreck, and Eric Chi

EXECUTIVE SUMMARY

Data centers are running low on space, power, and cooling. When it comes time to provision new data center capacity, IT infrastructure and operations (I&O) professionals are faced with the critical decision to either lease or build. There are use cases for both approaches. Leasing a data center presents an attractive operational expenditure model, better access to space and power, and the ability to expand faster. Building a data center provides more control over the facility and its operations and allows organizations to leverage and share existing space. So what should you do? Forrester's Total Economic Impact™ (TEI) analysis finds that building a data center is not economical for most companies. This report will help infrastructure and operations professionals decide when to lease and when to build a data center given their unique circumstances.

TABLE OF CONTENTS

- 2 **Choose Wisely: Data Center Facilities Are Your Most Expensive Investment**
- 3 **Three Factors Determine The Economics Of Data Center Facilities**
- 9 **For Most Companies, Leasing Is More Cost-Effective Than Building**

RECOMMENDATIONS

- 11 **Beyond Dollars And Cents, Consider Core Competencies, Risk, And Forecast**

WHAT IT MEANS

- 12 **Modular Data Centers Are Disruptors To This Model**
- 12 **Supplemental Material**

NOTES & RESOURCES

Forrester interviewed 15 companies: Align Communications, CoreSite, Data Foundry, Digital Realty Trust, Dimension Data, Equinix, HCL Technologies, HP, IBM, Internap Network Services, Interxion, i/o Data Centers, Lee Technologies, Romonet, and Telecity Group. We used this information to create a cost model based on our TEI analysis framework.

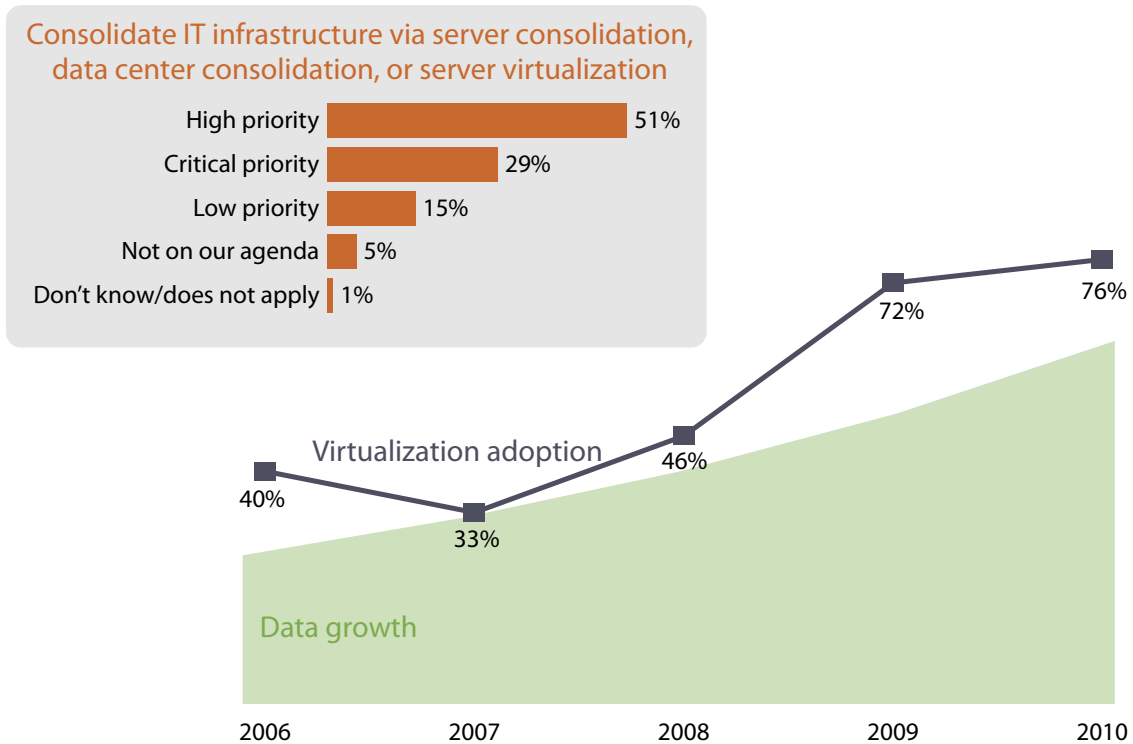
Related Research Documents

- ["Inquiry Spotlight: Data Center Facilities, Q2 2009"](#)
May 8, 2009
- ["Retrofitting Your Data Center For Better Capacity"](#)
October 29, 2008
- ["Don't Build Your Next Data Center, Colocate It"](#)
October 21, 2008

CHOOSE WISELY: DATA CENTER FACILITIES ARE YOUR MOST EXPENSIVE INVESTMENT

Chances are that your data center facility is reaching its space, power, or cooling capacity. Forrester finds that there are three primary drivers behind this: data growth, virtualization, and consolidation (see Figure 1). Forrester estimates that storage consumes somewhere between 5% and 15% of the total power consumed in the data center, and with a data growth rate of between 25% and 50% each year, the explosion of data growth is having a real impact on data center capacity. Likewise, as organizations drive their virtualization deployments to greater densities of virtual machines per physical machines, organizations are driven to look for new facilities that can support more extreme densities. At the same time, I&O professionals are consolidating their multitudes of small data closets and data centers into centralized regional sites. The result: Many IT I&O professionals are in the market for a new data center.

Figure 1 The Perfect Storm: Data Growth, Virtualization, And Consolidation



Base: 1,037 North American and European IT executives and technology decision-makers

Source: Forrsights Hardware Survey, Q3 2010

The decision of how to provision a new data center can't be taken lightly, as it will most likely be your largest infrastructure investment — what else will cost tens of millions of dollars to provision and maintain over its lifetime? Many companies don't fully understand the costs associated with building *and operating* a data center before they commit to that path. Similarly, many organizations don't fully investigate the risks that they are potentially shouldering. Before making this big decision, it's imperative that I&O professionals understand all the options — their pros and cons as well as their risks and costs.

THREE FACTORS DETERMINE THE ECONOMICS OF DATA CENTER FACILITIES

It's imperative that I&O professionals objectively evaluate the financial impact on business when considering leasing versus building a data center. How? Companies can use a simplified version of Forrester's Total Economic Impact model to systematically consider the following:

1. **Benefits.** How will your company benefit from leasing versus owning a data center?
2. **Costs.** How will your company pay for your data center facility (hard and soft costs as well as resources)?
3. **Risks.** How do uncertainties change the total impact of a data center on your business?

Key Benefits Of Leasing: Flexibility, Cost Model, And Time-To-Market

Organizations looking to provision a new data center facility can expect several benefits from either building their own facility or from leasing from a provider. The scale, timing, and duration of these benefits can be estimated by considering one or more key metrics and the value to the organization of improving those metrics over time (see Figure 2). For many organizations, the benefits of leasing outweigh the benefits of building a data center. The most common benefits of leasing include:

- **A predictable and operational expenditure model.** The monthly costs of leasing a data center are easy to predict, and they increase at a consistent rate over the life of the data center. An internally owned and operated data center, however, could require unforeseen maintenance on equipment and will have spikes in costs around the three-to-five-year mark as a result of equipment refreshes. Additionally, instead of a large upfront expenditure at the time of construction, leasing a data center is an operational cost spread over many years.
- **Additional capacity can be brought on quickly, cheaply, and only as-needed.** Assuming the colocation or lease provider has capacity available, the process of expanding the data center footprint is much faster than retrofitting or expanding an internally owned data center. And capacity can be provisioned in more of a modular or “on-demand” model instead of building out extra capacity that might not be used for many years.

- **Better access to space and power.** Colocation providers build and manage data center space for many organizations. As a result, they have a massive amount of purchasing power that can be leveraged into more competitive prices on space, utility rates, and power and cooling infrastructure.
- **Experienced professionals managing your data center facility.** Most likely, running a data center is not part of the core expertise of your company. The data center facilities provider will almost certainly have more experience and expertise in the practice of running an efficient and highly available data center facility.
- **An ecosystem of partners in the same facility.** Leasing space in a data center facility most likely means you won't be the only tenant in the building. While some organizations view this as a detractor rather than a benefit, consider this: The other tenants in the building are often service providers whose services you can leverage with extremely low latency via a cross-connect. Whether it's a network provider, financial trading platform, or application-hosting provider, most large colocation and lease facilities are attracting a larger system of partners and tenants that you can benefit from.

Figure 2 Key Benefits Of Leasing Versus Building A Data Center

Leasing a data center	Building a data center
A predictable and operational expenditure model with costs that are easy to predict and that increase at a consistent rate over the life of the data center	Complete control over operating environment from who can access the facility to the temperature that it runs at
Additional capacity can be brought on quickly and only as-needed, shielding you from having to build out extra capacity that might not be used for many years.	Very low risk of losing your lease and being forced to leave the facility
Better access to space and power through the colocation provider's purchasing power	Ability to leverage and share existing space, giving IT staff the ability to work in close proximity to the data center floor for a low cost
Data center is run by experienced professionals with more experience and expertise in the practice of running an efficient and highly available data center facility.	
An ecosystem of partners in the same facility that can be leveraged with extremely low latency via a cross-connect	

Key Benefits Of Building: Control And Ability To Leverage Existing Space

Organizations that choose to build and operate their own data centers often do so to achieve the following benefits:

- **Complete control over operating environment.** Building a data center gives you control over every aspect of the environment from who can access the facility to the temperature that it runs at. If you face regulations that require you to restrict access to the data center floor to employees only this could be an important decision-point in the lease versus build discussion. Additionally, owning your own data center means that you control the maintenance window timing and duration, the type of cooling systems that are deployed, and any retrofits or improvements made to the facility.
- **Very low risk of losing your lease.** Owning the facility and potentially the real estate as well means that the risk of being forced to leave the facility is very low compared with a colocation facility where a new lease is negotiated periodically.
- **Ability to leverage and share existing space.** Most likely you already have empty office space that could be converted into a low resiliency data center by retrofitting with the required power and cooling. Conversely, owning your own data center means you can easily build out office space in the data center to allow IT staff to work in close proximity to the data center floor.

Key Leasing Costs: Setup Fees, Cross-Connects, Lease Payments, And Power

The cost model for colocation is much simpler than building a data center — there are very few upfront costs and the majority of the expenditure is operational. The most significant costs of leasing a data center include (see Figure 3):

- **Upfront fees: setup fees, move-in costs.** Not all providers will charge a setup or a move-in fee, but for the ones that do, the cost is usually equal to the cost of the first month's rent. These fees will usually apply if you require any customization to the space or if you're moving into a private suite.
- **Network cross-connect fees.** Depending on the region, these may be one-time upfront fees or a monthly fee paid along with the rent. Like setup fees, some providers don't charge for cross-connects at all. The cross-connect fees can range from a few hundred to a few thousand dollars per month, depending on the network speed and number of drops.
- **Monthly lease payments.** Historically, data center lease rates have been calculated per square feet or square meter. Increasingly, data center providers are changing the conversation to the critical power requirements and charging rent by the breaker amp plus an agreed-upon overhead for environmental. Pricing will vary by the data center resiliency, provider type — wholesaler or retailer — and by region.¹ This means the range is incredibly wide for what you might see for the monthly lease payments but will usually fall within the range of \$100 to \$700 per kW of IT load per month.

- Power.** At a leased data center facility, power will be billed at either a metered or a flat rate; wholesale providers will usually bill power at a metered rate as it's consumed, retail providers will charge for power on a flat rate per amp or blended in with the rent cost. If the power is metered, expect to pay the local commercial power rate, or lower, plus a multiplier (usually equivalent to the building's PUE) to account for power used by the data center infrastructure and other environmentals. Providers that charge a flat rate for power will usually bill \$15 to \$50 per breaker amp per month.

Figure 3 Key Costs Of Leasing Versus Building A Data Center

Description	Capital or operational expenditure?	Leasing a data center	Building a data center
Upfront fees	Capex	Setup fees and move-in costs are usually equal to the cost of the first month's rent.	Upfront planning, design, and commissioning is 20%-25% of the total upfront construction cost
Base building shell and physical security	Capex	Not applicable	\$100-\$300 per square foot
Fire suppression and detection equipment and installation of the systems	Capex	Not applicable	\$20,000 and \$60,000
Building permits and local taxes	Capex	Not applicable	Variable by region
Data center infrastructure (mechanical and electrical) procurement and installation	Capex	Not applicable	\$7,000-\$20,000 per kW of IT load
Network cross-connect fees	Capex or Opex	Network cross-connect fees range from a few hundred to a few thousand dollars per month, depending on the network speed and number of drops.	Variable by region and network speeds. Cost to bring fibre to building is estimated at \$10,000 per mile.
Monthly lease payments	Opex	\$100-\$700 per kW of IT load per month	Not applicable
Power	Opex	Metered power: local commercial power rate, or lower, plus a multiplier to account for overhead power Flat rate power: \$15-\$50 per amp per month	Will account for 70%-80% of ongoing operational costs. Average industrial power rate of \$0.0677 per kWh in the United States to €0.0836 per kWh in Western Europe.
Data center staffing	Opex	Remote hands/smart hands: \$200-\$300 per hour	Variable by region
Annual facility and infrastructure maintenance	Opex	Not applicable	Annually 3%-5% of the initial construction cost

- **Data center staffing: remote or smart hands.** An additional service that most colocation providers offer is remote or smart hands: The vendor performs simple tasks in the data center such as racking or rebooting a server. It's not usually required that companies purchase these services, but many companies do take advantage of remote or smart hands to avoid sending staff over to a facility to perform basic tasks. The pricing for remote or smart hands typically ranges from \$200 to \$300 per hour and can be purchased as a bundle with the lease agreement.

Key Building Costs: Power, Space, Infrastructure, Design, Monitoring, And Management

Unlike leasing, the costs associated with building your own data center are primarily capital expenditure. The upfront costs of the architectural designs and plans and the build-out of capacity are often in the millions of dollars. In addition to these upfront costs, there are ongoing operational costs of power, staffing, and maintenance. For organizations building a data center facility, the major cost categories are:

- **Upfront planning, design, and commissioning.** Upfront planning and design costs account for a significant portion of the upfront costs of building a data center — expect these costs to be in the range of 20% to 25% of the total upfront construction cost. Included in these costs are fees pertaining to the architectural design, engineering design, project management fees, impact studies, contingency fees, and commissioning costs, to name a few.
- **Base building shell and property.** If starting with an existing building shell, as many who build new data centers opt to do, you can disregard the costs and time of the building shell and property. However, if your future data center is currently still a bare patch of land, make sure to account for real estate acquisition costs such as transaction, consultant, or brokerage fees and building shell construction costs including excavation, grading, roadways, tie-ins to utilities, physical security, and the shell itself. Forrester estimates that the cost of building the data center shell including the physical security is \$200 per square foot. Since property costs are extremely variable by region and often not included as part of the data center expenditure by many companies, this component is not included in this model.
- **Fire suppression and detection.** Data centers require complex and specialized fire suppression systems, such as inert gas blends, pure carbon dioxide, FM-200, and 3M Novec 1230 Fire Protection Fluid.² Most data centers also have very early smoke detection apparatuses (VESDA) to provide advanced fire detection. Forrester estimates that the fire suppression and detection systems will cost between \$20,000 and \$60,000 to purchase agents and equipment and to install the systems for a several thousand square foot data center.
- **Building permits and local taxes.** The cost of building permits and taxes paid when building a new data center facility are highly variable from region to region and will vary significantly even within regions. For the purpose of this model, Forrester estimate \$70 per square foot in building permits and local taxes, which represents a moderate cost in the United States.

- **Data center infrastructure.** The bulk of the cost of building a data center lies in the purchasing and installation of the mechanical equipment (e.g., computer room air conditioning units, refrigerant loop, condenser plant or chiller, water tank) and electrical equipment (e.g., power distribution units, transformers, patch panels, UPSes, auto transfer switches, generators). Depending on the resiliency, the cost for the mechanical and the electrical can range from around \$7,000 to \$20,000 per kW of IT load.
- **Network connection cost.** Unless the building already has adequate network connectivity, you will have to pay for fibre to be brought out to your site. There are many factors that impact this cost, but for the purpose of this model, Forrester estimates this cost to be around \$10,000 per mile upfront.
- **Power.** The biggest expense when running a data center is power, which accounts for approximately 70% to 80% of the overall cost of running a data center facility. These costs are highly variable by region — and even within regions — and can range from an average industrial power rate of \$0.0677 per kWh in the United States to €0.0836 per kWh in Western Europe.
- **Data center staffing.** All data centers, even lights-out facilities, require some amount of data center staffing. Many companies choose to have their data centers monitored 24x7x365 by security and operations staff. Additionally, many organizations will have IT engineering staff on-site to perform maintenance and optimization of equipment. After power, staffing is the largest expense associated with running a data center and will cost in the hundreds of thousands of dollars per year, depending on location and staffing levels.
- **Annual facility and infrastructure maintenance.** While the annual facility and infrastructure is the most unpredictable of the ongoing costs of a data center, on average, companies should expect a base cost of 3% to 5% of the initial construction cost. On top of that baseline, there will be additional replacement or major repair costs starting around the third year of data center operation. For example, the batteries in a traditional, non-flywheel UPS will need to be replaced every five years, which costs around \$100 per kW.

A note about depreciation and real estate taxes: Data centers are typically depreciated over the course of 15 years. Companies use the depreciation benefits in many different ways on their taxes and profit-and-loss statements. Real estate taxes are variable by region and are not usually included, borne by the facilities or real estate groups, not by IT. For these reasons neither depreciation nor real estate taxes are included in this model.

Risk Analysis: Data Center Capacity Planning And Rights Of Renewal

No change — or avoidance of change — is without risk. Factoring this uncertainty into the analysis converts an optimistic, and potentially unachievable, plan into one with higher accuracy. This is particularly important for data center lease versus build decisions given the sizable capital and operating expenses. Initial estimates can be refined by factoring in the following risks:

- **When leasing: being forced to move out of a colocation facility.** The primary risk that is undertaken when leasing a data center is that of being forced to leave the facility. This could occur if the facility reaches capacity and you can't expand your footprint as needed, or if the provider decides not to renew your lease at the end of your term. Either way requires an unexpected data center move, which is not only expensive but also potentially disruptive.
- **When building: over- or underprovisioning your data center facility.** One of the biggest risks associated with owning your own data center facility is not sizing it correctly. If you don't build out enough capacity (which is often the case), you will be faced with expensive retrofits long before originally planned that can be as costly as the initial build. Overbuilding a data center facility is risky as well, as data center infrastructure (and IT infrastructure for that matter) is most efficient at peak load, making it very inefficient to run a mostly empty data center facility. For example, a data center that is completely empty of IT equipment will still take 30% to 40% of its peak power load to run.

FOR MOST COMPANIES, LEASING IS MORE COST-EFFECTIVE THAN BUILDING

On the surface, the total costs of building versus leasing a data center over 15 years are very comparable (see Figure 4). From the original estimates, the net present value (NPV) of building and managing an enterprise-owned data center that will last for the next 15 years is just under \$29 million, while the lease costs are just over \$30 million. However, when risk is factored into the equation, the numbers begin to diverge. In our "most likely" scenario estimates, the NPV of building and managing an enterprise-owned data center over 15 years jumps to almost \$47 million, while leasing is just under \$35 million. When considering the risks and more realistic outcomes in this scenario, Forrester's analysis finds that it makes more economic sense to lease rather than build a data center facility.

To arrive at a quantitative assessment of the economic implications of building versus leasing a data center, Forrester evaluated the key drivers of benefits, costs, and risks for a hypothetical organization procuring a new data center with the following specifications:

- **Power.** The facility is built out to support one megawatt of IT load with a PUE of 1.5. At the move-in date, only 500 kilowatts is required to power the IT infrastructure.
- **Space.** The data center facility requires 6,000 square feet (550 square meters) for IT infrastructure and an additional 3,000 square feet (275 square meters) for the data center infrastructure.
- **Resiliency.** All critical infrastructure components are redundant and concurrently maintainable. The data center has a targeted uptime of around 99.98% (Tier III equivalent).
- **Growth.** Data center power requirements will grow by 10% each year. The colocation agreement includes a 4% base rent escalator per year.

- **Operations and management.** The facility is staffed and operational 24x7x365 by at least two personnel. An annual salary of \$35,000 per year was used for the security and data center monitoring staff, a salary of \$65,000 per year was used for the IT technician staff salary. An additional 30% labor burden was added to each salary for insurance, healthcare, taxes, and other expenses. The colocation agreement also includes 80 hours of remote hands services at a rate of \$200 per hour. The colocation agreement also includes a management fee of 5% per year.
- **Climate and location.** The data center is located in a moderate climate with average power costs. For this scenario, we used the power cost of \$0.0677 per kWh.

Figure 4 Total Economic Impact Analysis Summary**4-1 Model: Total economic impact analysis summary — leasing a data center**

Original estimates	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10	Year 15	Total	Present value
Total benefit	\$1.32	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$1.32	\$1.22
Total cost	\$1.99	\$2.08	\$2.29	\$2.51	\$2.76	\$4.57	\$7.59	\$62.13	\$30.83
Net cash flow	\$(.68)	\$(2.08)	\$(2.29)	\$(2.51)	\$(2.76)	\$(4.57)	\$(7.59)	\$(60.81)	\$(29.61)
Cumulative cash flow	\$(.68)	\$(2.76)	\$(5.04)	\$(7.56)	\$(10.32)	\$(29.39)	\$(60.81)		

NPV \$(29.60)

Most likely estimates	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10	Year 15	Total	Present value
Total benefit	\$1.18	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$1.18	\$1.10
Total cost	\$2.28	\$2.39	\$2.63	\$2.89	\$3.18	\$5.25	\$8.70	\$71.44	\$35.44
Net cash flow	\$(1.10)	\$(2.39)	\$(2.63)	\$(2.89)	\$(3.18)	\$(5.25)	\$(8.70)	\$(70.25)	\$(34.35)
Cumulative cash flow	\$(1.10)	\$(3.49)	\$(6.12)	\$(9.01)	\$(12.19)	\$(34.12)	\$(70.25)		

NPV \$(34.30)**4-2 Model: Total economic impact analysis summary — new data center build**

Original estimates	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10	Year 15	Total	Present value
Total cost	\$16.14	\$1.28	\$1.35	\$1.42	\$1.69	\$1.99	\$2.96	\$43.28	\$28.69
Net cash flow	\$(16.14)	\$(1.28)	\$(1.35)	\$(1.42)	\$(1.69)	\$(1.99)	\$(2.96)	\$(43.28)	\$(28.69)
Cumulative cash flow	\$(16.14)	\$(17.42)	\$(18.77)	\$(20.18)	\$(21.87)	\$(30.94)	\$(43.28)		

NPV \$(28.70)

Most likely estimates	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10	Year 15	Total	Present value
Total cost	\$24.03	\$2.27	\$2.38	\$2.50	\$2.99	\$3.52	\$5.24	\$71.99	\$46.54
Net cash flow	\$(24.03)	\$(2.27)	\$(2.38)	\$(2.50)	\$(2.99)	\$(3.52)	\$(5.24)	\$(71.99)	\$(46.54)
Cumulative cash flow	\$(24.03)	\$(26.30)	\$(28.68)	\$(31.18)	\$(34.17)	\$(50.19)	\$(71.99)		

NPV \$(46.50)

Note: All numbers are in millions

RECOMMENDATIONS

BEYOND DOLLARS AND CENTS, CONSIDER CORE COMPETENCIES, RISK, AND FORECAST

The nonfinancial benefits of building or leasing a data center are critical decision points. However, IT I&O professionals must think beyond just dollars and cents. Beyond calculating the total economic impact of a leased versus owned data center, Forrester recommends that I&O leaders ask themselves the following questions:

- **Is owning and operating a data center a strategic differentiator?** An important consideration in the lease versus build decision is core competency. An important question to ask yourself is whether you want to be in the business of running a data center. Can you operate a data center facility as well as, or better than, a third-party provider? For most companies, the answer is no, and they would be better off directing resources toward other more differentiated or strategic areas. But in some cases, the answer is yes, if your organization is a producer or operator of technology or a large operator of industrial space, for example. In these less common cases, when it is a strategic differentiator to run a data center, whether or not it makes economic sense for the company, building is the more advantageous option.
- **How effective is my organization's capacity planning capability?** An important early step in planning for a new data center is forecasting how much capacity your organization will require. If you're building a data center, you will need to forecast out the capacity for up to 15 years in advance, a difficult task for many companies. If leasing, the forecast only needs to extend to the life of the lease, generally less than five years.
- **What is my organization's risk tolerance and culture?** Building a data center facility is accompanied by the risks associated with making a massive capital investment. However, leasing a data center facility has associated risks involving the loss of control of every aspect of a facility. Which of these risks is more tolerable to your specific organization? Additionally, leasing a data center often means moving infrastructure away from the headquarters of the company. Some company cultures will not be accepting of the idea of moving the physical infrastructure to a different building (or city) than the IT staff and monitoring and managing the data center remotely.

WHAT IT MEANS

MODULAR DATA CENTERS ARE DISRUPTORS TO THIS MODEL

The primary disruptor to the traditional data center lease versus build model outlined above is the advent of the modular data center. Modular data centers are prefabricated units that are shipped to the customer site and then assembled. The total procurement time of these units usually can be measured in weeks to months. The units are built out in standard amounts of capacity, usually 750 kW to 800 kW each, and can be linked together to build out a much larger space.³ Using modular data centers, organizations can overcome several of the disadvantages of building a data center, namely fast time-to-market and ability to expand with minimal cost and disruption. While modular data centers will never replace leased data center providers, they do offer an additional option for companies to consider when they're sourcing a new facility.

SUPPLEMENTAL MATERIAL

Online Resource

The underlying spreadsheet detailing the model in Figure 4 is available online.

The online version of Figure 4 is an interactive tool to determine the total cost of leasing versus building a data center facility.

Methodology

Forrester Research uses a defined methodology for analyzing and evaluating the costs, benefits, and risks of a proposed solution. This methodology, termed Total Economic Impact (TEI), provides a holistic view of the decision by including an analysis of costs, benefits, flexibility, and risk. By including an assessment of risk, TEI provides a realistic view of expected outcomes, rather than one shaded by early optimism and enthusiasm.⁴

Unlike a cost- or technology-based analysis, TEI does not rely on industry averages or factors that are applied to all organizations, but is a methodology for evaluating projects. The TEI methodology forces the determination and quantification of relevant metrics in light of an organization's current state and future goals. Firms can use the TEI model as a proactive and predictive tool.

Companies Interviewed For This Document

Align Communications	IBM
CoreSite	Internap Network Services
Data Foundry	Interxion
Digital Realty Trust	i/o Data Centers
Dimension Data	Lee Technologies
Equinix	Romonet
HCL Technologies	Telecity Group
HP	

ENDNOTES

- ¹ Wholesale data center providers have a minimum amount of space or power they are willing to lease, which is usually around the capacity of an entire power distribution unit, with the square footage dictated by the number of kilowatts required. Wholesalers usually pass along their actual power costs, offer few managed services, and allow you to customize your space as you would in an office building. In addition, wholesale providers offer longer lease terms (around five to 15 years), sometimes with the option to renew at a predictable rate. Regional and national retail providers don't require that you lease a minimum amount of space in order to colocate with them. You can lease as little as part of a rack to several cages that hold multiple racks. Rather than following a kilowatt-driven pricing model, retailers determine your costs by the amount of space you require, plus whatever options you select. And there are a number of options: Retail providers offer a variety of managed services, charge a flat rate for power circuits, and have shorter leases (around one to two years) with no renewal options. For more information, see the October 21, 2008, "[Don't Build Your Next Data Center, Colocate It](#)" report.
- ² If you're installing a new system today, there are four main agents being deployed: inert gas blends, pure carbon dioxide, FM-200, and 3M Novec 1230 Fire Protection Fluid. The inert gas blends and CO₂ are based on naturally occurring gases, in contrast with FM-200 and Novec 1230, which are both manufactured agents. While FM-200 and Novec are comparable in their system design and effectiveness, FM-200 is a hydrofluorocarbon, which means it has a high global warming potential. Novec is technically a fluoroketone, and while it is significantly more expensive, it has an atmospheric lifetime of only five days, and little global warming potential. See the October 1, 2007 report, "[Data Center Fire Suppression 101](#)" report.
- ³ Source: Rachel Dines, "Levittown Data Centers All The Rage This Month," *Rachel Dines' Blog For Infrastructure And Operations Professionals*, July 27, 2010 (http://blogs.forrester.com/rachel_dines/10-07-27-levittown_data_centers_all_rage_month).
- ⁴ For an in-depth discussion of TEI and the individual elements within the methodology, please see the August, 4, 2008, "[The Total Economic Impact™ Methodology: A Foundation For Sound Technology Investments](#)" report.

FORRESTER®

Making Leaders Successful Every Day

Headquarters

Forrester Research, Inc.
400 Technology Square
Cambridge, MA 02139 USA
Tel: +1 617.613.6000
Fax: +1 617.613.5000
Email: forrester@forrester.com
Nasdaq symbol: FORR
www.forrester.com

Research and Sales Offices

Forrester has research centers and sales offices in more than 27 cities internationally, including Amsterdam; Cambridge, Mass.; Dallas; Dubai; Foster City, Calif.; Frankfurt; London; Madrid; Sydney; Tel Aviv; and Toronto.

For a complete list of worldwide locations visit www.forrester.com/about.

For information on hard-copy or electronic reprints, please contact Client Support at +1 866.367.7378, +1 617.613.5730, or clientsupport@forrester.com.

We offer quantity discounts and special pricing for academic and nonprofit institutions.

Forrester Research, Inc. (Nasdaq: FORR) is an independent research company that provides pragmatic and forward-thinking advice to global leaders in business and technology. Forrester works with professionals in 19 key roles at major companies providing proprietary research, customer insight, consulting, events, and peer-to-peer executive programs. For more than 27 years, Forrester has been making IT, marketing, and technology industry leaders successful every day. For more information, visit www.forrester.com.