Cloud Economics

Cloud economics is the study of cloud computing's costs and benefits and the economic principles that underpin them. As a discipline, it explores key questions for businesses: What is the return on investment (ROI) of migrating to the cloud or switching current cloud providers? And what is the total cost of ownership (TCO) of a cloud solution versus a traditional on-premises solution?

When individual businesses understand the economics of cloud computing, they can optimize their investments and obtain the greatest value for their organization.

Cloud economics involves two primary principles:

- economies of scale

  Cloud providers save organizations money because they purchase computing resources in massive quantities at lower costs.

  When companies utilize these shared resources, they avoid the substantial up-front CAPEX costs of purchasing their own expensive infrastructure.

  And with a pay-as-you-go pricing model, companies pay only for the resources they actively use, scaling up or down as needed.

- global reach

  When servers no longer need to be housed on premises—they can be located and accessed from anywhere in the world—companies can dramatically reduce labor costs.

  Their IT teams no longer need to devote time to deploying and maintaining complex hardware on site.

Beyond the tremendous efficiencies and cost savings of cloud computing, there is another economic benefit:

business agility

Companies that utilize cloud computing resources can deploy applications faster and ramp up storage and computing power on demand. This IT agility allows businesses to respond to market changes and customer demands more quickly, leading to faster revenue growth.

Making the business case for cloud economics

Before making the leap to cloud, businesses should analyze the economic pros and cons in depth to get a detailed picture of specific costs and savings.

Will it lead to long-term savings and efficiencies?

The answers will vary depending on the organizational needs and circumstances and on the cloud solution being considered. The goal is to avoid a cloud adoption strategy that drives up cost, complexity and staffing resources.

When exploring cloud economics for their company, IT and finance managers can follow a basic process to determine cloud computing ROI and TCO, and use those estimates to help make their case to executives. The process should include these three elements:

Benchmarking: Calculate the cost of operating your current data center, including capital costs over the equipment lifespan, labor costs and any other maintenance and operational costs, from licenses and software to spare parts.

Cloud costs: Estimate the costs of the cloud infrastructure you're considering (public cloud, private cloud, hybrid cloud, etc.). You'll need a quote from your vendor, but look beyond this basic pricing structure to consider ongoing fees, labor and training costs, ongoing integration and testing of apps, as well as security and compliance.

Migration costs: Determine the cost to migrate IT operations to the cloud or to switch cloud providers. These costs should include labor and expenses to integrate and test apps.

With hard numbers in hand, IT managers can compare the TCO of different cloud architectures and scenarios. This way they can make a stronger case for the business value of cloud adoption to the decision-makers in their organization.

What IT needs to know about cloud economics

Cloud economics goes beyond just cutting cloud computing costs; it's about meeting business goals through greater speed and agility.

Understanding the larger perspective in this way will help IT teams choose the best cloud solution for their needs.

IT teams should also be careful to approach their decisions around cloud economics with objectivity and an awareness of basic behavioral economics. A host of potential biases and blind spots can negatively affect their decision making:

- **Overconfidence blind spot:** Being too confident in your understanding of costs and project timelines.

- **Recency blind spot:** Considering choices soberly versus being wowed by the latest technology.

- **Confirmation blind spot:** Letting pre-existing notions or false beliefs affect your objective review of the information.

- **Refactoring and rework blind spot:** Underestimating the time and money to refactor applications to run in the cloud.

- **Talent reskilling blind spot:** Overlooking the cost to retrain or maintain multiple operations teams.

- **Operational costs blind spot:** Not paying attention to the full cloud cost structure, such as provider charges for data egress.

Cloud Economist

A cloud economist is an expert in cloud economics: principles, costs, and benefits. Cloud economists help businesses forecast their costs and savings for a new cloud solution. A TCO business case analysis from a cloud economist can serve as an invaluable decision-making resource.

In a final TCO and ROI presentation, they can compare cloud solutions for you, highlighting pricing structures, costs and savings (including capital costs versus operating costs), line-of-business impacts, recommendations, and next steps.

What is Cloud ROI?

Cloud ROI is the measure in cloud economics of the impact a cloud investment has on an organization.

For most businesses, return on investment (ROI) is a success indicator for any project – signifying that a business decision led to a positive impact on the organization's bottom line. The measure of ROI is simply the increase in the value of an investment over a period of time. If the financial benefit outweighs the original investment the result is a positive ROI.

Cloud ROI is impacted by initial outlay, the speed with which returns occur, and cost decreases that occur as a result of the investment. For example, moving to a public cloud provider decreases capital expenditures, but increases monthly costs.

ROI has both tangible and intangible components – a complete ROI picture must include factors such as overall corporate value, customer goodwill, and brand value in the marketplace, to name a few.

Some key factors when **calculating cloud ROI** include:

Productivity. If cloud adoption enables the business to meet peak demands rapidly productivity can be enhanced and opportunities gained that might have been lost without cloud scalability.

Leverage. A single cloud platform such as AWS or Azure can provide the organization with the basic infrastructure to manage many applications. The virtualized nature of cloud services enables resource sharing of VMs and storage pools between multiple departments, and a cloud providers multi-tenancy offers economies of scale that can make cloud services less expensive than on-premises servers and storage for many organizations.

Pay as you go. By eliminating capital expenditures, organizations pay for only those cloud services actually used in a give time period. There is no need to pre-pay for infrastructure necessary to meet peak demands UNTIL those peaks occur, and then organizations only need pay for increased capacity when it is needed. The same is true of software licenses; only pay for those you need when you need them.

Provisioning time. Since procuring and deploying new infrastructure in the cloud is virtually instantaneous, new projects can be launched immediately rather than waiting for hardware to be ordered, configured, shipped, and installed. This also has a strong impact on time to value since work can begin immediately upon project approval.

Capital spending reduction. Migrating applications to the cloud eliminates the need to spend for on-premises infrastructure, as well as eliminating support and upgrade requirements. Lower costs translates to higher profitability and increased ROI.

Access to new market. Faster delivery and lower costs translate to more competitive offerings, which can open the door to new customers and markets worldwide.

Cloud risk management. Calculating the cost of project failure, infrastructure outages and natural disasters, as well as ways to mitigate them, via disaster recovering solutions.

What are the benefits of measuring cloud ROI?

You cannot manage what you cannot measure and measuring cloud ROI gives an organization the understanding of how a cloud project can impact the bottom line over a period of time. Since IT infrastructure investments often have a three-to-five year lifecycle, calculating the cloud ROI for a similar timeframe can demonstrate how substantial the payback can be for cloud investments made today. Migration cost can be demonstrated to translate into operational excellence, cost savings, and enhanced scalability, helping to green-light potential cloud projects.

Some benefits that can be realized as a result of determining a positive cloud ROI include:

- Reduced or eliminated software license costs
- Increased business agility and faster responses to business unit inquiries
- Reduced operational expenses – no more servers or ancillary infrastructure
- Shared cloud resources that all user departments can benefit from
- Improved energy efficiency and reduced electricity bills
- Retiring of IT assets, racks, data centers, and real estate expenditures

How do you measure Cloud ROI?

Cloud ROI is the ratio of monetary gain from an investment. However, in a complex organization it may not be immediately clear exactly what the investment is and what the gains are. A good place to start is by calculating the total cost of ownership for the cloud investment, taking into account savings realized by retiring no longer used infrastructure and facilities.

Once those numbers are in hand Cloud ROI is calculated using a simple formula:

(Gain from investment – investment) / (investment) = ROI

An organization's ROI can be calculated using the gains realized from the TCO (investment). When calculating the TCO, be sure to include:

Switching cost and time of moving to the new platform.

Skill acquisition (and productivity loss) for training for new platform

Risk factors around lock-in to new platform

New economic model, understanding the new set of cash flows that will result from the new platform

Other considerations are total costs over time, software and license fees not included in contracts, and cost of any third-party or professional services required.

Although many organizations will start by determining cloud ROI for a single fiscal year, it is important to understand that the savings from a cloud migration will increase over time, since there the migration has already been paid for in year one. That means the 3 or 5 year ROI for a cloud project can be significantly greater than the one year ROI. These considerations should be made clear to all stakeholders while doing the initial evaluation for cloud migration, since one-year ROI may look marginal while three-year ROI shows substantial gains as a result of the cloud project.

For example, a 900,000 one-year gain from a 1,000,000 cloud investment shows a negative ROI in year one,

but 2 years ROI of _____ ?

3 years ROI of _____ ?

4 years ROI of _____ ?

What is Cloud TCO?

Cloud TCO is a formula from Cloud Economics used to calculate all costs and benefits related to a cloud computing project. It is used to determine the true, all-in costs which then can be compared to alternatives.

Although some cloud providers offer a TCO calculator, organizations should perform their own evaluations, since each cloud deployment is different, and gaining an understanding of the costs savings realized by a cloud project can be equally elusive.

Factors that can impact the total cost of ownership include the type of business, the functions and processes supported by the cloud, cost of training and education, impact on facilities expenses including power and cooling, regulatory impacts, cloud risk management and improvements due to a cloud project such as increased efficiency, faster decision-making, or reduced capital expenditures.

When defining a cloud TCO model existing and future infrastructure must be accounted for. Some attributes of a TCO model should include:

- Actual cost of operating cloud services as load changes due to demand

- Migration costs to rehost applications on cloud platforms including code changes and refactoring to support cloud or hybrid environments
- Sunk costs due to retiring existing on-premises infrastructure, including facilities costs if data center is no longer needed
- Costs to alleviate compliance risks created by migrating off-premises, such as potential HIPAA (The Health Insurance Portability and Accountability Act of 1996) or GDPR (General Data Protection Regulation) violation costs
- Human costs involved in retraining or hiring new staff to ensure the proper skill sets for managing cloud solutions
- Potential value of eliminating capital expenditures with a cloud migration
- Potential value of increased agility in terms of meeting changing market demand, speeding time to market, and spinning up new cloud applications once a cloud platform has been adopted

Keep in mind that a TCO model is just that – a model – and should be adjusted over time as new factors and attributes are exposed. Every organization will have its very own TCO model since no two organizations have the same starting and ending points when it comes to cloud migration.

How to calculate TCO for software acquisitions?

Calculating lifetime TCO for software must include not only the cost of the software itself but also the costs relating to the infrastructure that software runs on.

Thus, a comprehensive *on-premises ERP solution* would include the costs of:

- Servers and storage and their maintenance and upgrades
- Datacenter acquisition, rental, and maintenance
- Electricity, heating, air conditioning, and other utilities
- Human capital dedicated to maintaining physical data center and infrastructure

Whereas a *cloud-based ERP solution* would take into account the costs of the software either as a purchase or license cost plus

- Cost of hosting on cloud platform
- Human capital to migrate and maintain application functionality
- Potential data egress charges incurred by cloud provider

What is lower TCO?

A lower TCO simply indicates a lower total cost for the useful lifetime of a given project or asset.

Some methods of lowering TCO include

- Reducing capital expenditures
- Speeding up migration and deployment of new functionality
- Increasing employee flexibility for work from home with mobility tools
- Increasing uptime to raise productivity

When it comes to lowering Cloud TCO, factors to consider include

- Assessing which cloud provider delivers the best value for a given project
- Lowering security risk by ensuring cloud and on-premises security is in sync
- Migrating backup, archival, and business continuity to cloud providers
- Eliminate on-premises maintenance by migrating to cloud providers

Although cloud migrations can lower overall TCO, your mileage may vary. Every organization must evaluate its unique business configuration and make its own assessment.

How do you calculate cloud TCO?

Every existing on-premises asset's TCO must be considered before Cloud TCO can be evaluated. Some costs that will disappear when migrating an application to the cloud include

- Server upgrades and replacement, typically done every 3-5 years.
- Ancillary equipment including racks, networking gear, load balancing equipment, storage devices, and the support, maintenance, and replacement of these over time
- OS, database, middleware, and application license fees
- Utility costs for electricity, heating, and cooling
- Waste due to the need to overprovision servers to meet peak demands
- Physical real estate or rental costs for data center equipment
- Inventory and asset management
- Project Risk
- Time and effort to switch from one platform to another.

These costs can be compared to the predictable monthly costs incurred by shifting operations to a cloud provider and can reliably be used to calculate the TCO for both on-premises and cloud-based solutions.

Why is TCO important?

TCO demonstrates the real, complete cost of a given solution over its lifetime – usually measure in 3-year or 5-year TCO. Management consider TCO when deciding to build or buy, when deciding if a solution is worth the investment, or when deciding whether to host an application on-premises or in the cloud. Reducing TCO increases an organizations bottom-line profitability. For example, a TCO reduction of 5 percent in an IT budget of 10 million translates to 500,000 directly to the organization's bottom line.

How to reduce TCO?

Traditionally TCO reduction is driven by waste reduction and capital re-deployment into opportunities that promise a higher return on investment (ROI). Gartner IT Key Metrics data says that nearly 60 percent of all IT costs are related to the acquisition and maintenance of IT infrastructure. Many organizations are migrating to cloud-based solutions to eliminate those sunk IT infrastructure costs and free up capital for more profitable ventures.
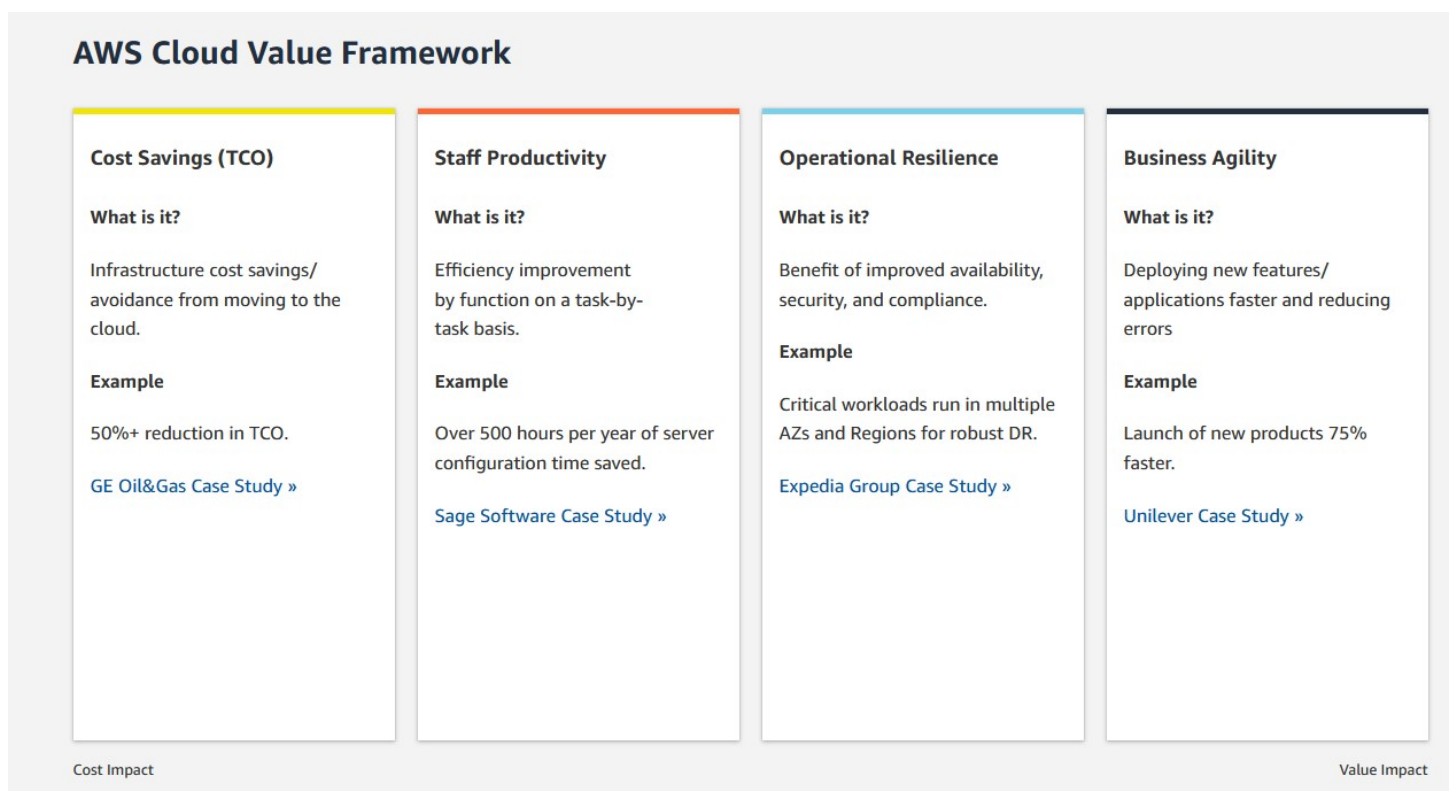
To achieve TCO reduction an organization must evaluate existing hardware and software assets and evaluate where waste can be eliminated and where migrating to subscription-based cloud solutions can free up capital previously allocated for hardware, data center, and maintenance costs.

Some TCO reductions that have emerged from cloud migrations include:

- Reduced complexity and operations costs
- Lower energy costs
- Reduced real estate footprint
- Faster time-to-market
- Lower overhead and maintenance costs

All of the above factors that contribute to a lower TCO translate to increased profitability for the organization.

https://aws.amazon.com/economics/

AWS Cloud Value Framework

Cost Savings (TCO)	Staff Productivity	Operational Resilience	Business Agility
What is it?	**What is it?**	**What is it?**	**What is it?**
Infrastructure cost savings/ avoidance from moving to the cloud.	Efficiency improvement by function on a task-by-task basis.	Benefit of improved availability, security, and compliance.	Deploying new features/ applications faster and reducing errors
Example	**Example**	**Example**	**Example**
50%+ reduction in TCO.	Over 500 hours per year of server configuration time saved.	Critical workloads run in multiple AZs and Regions for robust DR.	Launch of new products 75% faster.
GE Oil&Gas Case Study »	Sage Software Case Study »	Expedia Group Case Study »	Unilever Case Study »

Cost Impact   Value Impact

GE Oil & Gas Case Study

2016

GE Oil & Gas is migrating 500 applications to the cloud by the end of 2016 as part of a major digital transformation, helping it attain a 52 percent reduction in TCO. GE Oil & Gas is a business unit of global conglomerate General Electric, with energy-related operations around the world. The company's cloud migration project entailed reexamining—and in many cases, eliminating—legacy processes, resulting not only in lower IT costs but also in greater speed to market and more agility to compete even better in an industry

experiencing immense market challenges. GE Oil & Gas is using the *AWS Import/Export Snowball* appliance to transfer more than 750 terabytes of data from pipeline inspection machinery to AWS, as well as AWS services such as *Amazon Aurora, Amazon CloudWatch, AWS Elastic Beanstalk, and AWS Trusted Advisor.*

Sage Software Case Study

2014

Sage Software GmbH provides business software and services to more than 250,000 organizations throughout Germany. The company is a subsidiary of the Sage Group, one of the world's largest providers of Enterprise Resource Planning (ERP) software. Sage Software has approximately 700 employees in Germany and works with more than 1,000 product resellers. Sage Software's offerings are based upon more than twenty-five years of experience, and each solution is expertly tailored to meet local customer requirements. The company's extensive portfolio includes material management, production, accounting, business intelligence, human resource management, customer relationship management, and industry-specific solutions.

The Challenge

The Sage German Professional Services unit of Sage Software is responsible for consulting, training, pre-sales presentations, data migration, and replication of customer support cases.

The Professional Services team needs to run parallel systems for conducting training and for customer support. For example, a Developer Consultant may need to have a training project running virtually on one machine and then start a second machine to review a customer's issue. Additionally, team members often set up an application server and a database server in parallel so that students can work with them during a training session.

With this approach, it often took the Sage Software team at least two hours to install and configure virtual machines on employee notebooks and customers' local computers, and despite the extensive preparation, the virtual machines often performed poorly. After an eight-hour training or consulting session ended, employees would then spend an hour converting the systems back to their original states. The company knew that there had to be an easier way.

Why Amazon Web Services

Sage Software decided to create a cloud-based platform, the Sage Cloud Services Portal, to support its infrastructure requirements for training, consulting, and project management.

By using the Sage Cloud Services Portal, the Professional Services team is now typically able to handle the entire set-up for its training and consulting sessions within minutes. Thorsten Lass explains, "Instance actions, such as create, stop, start, and terminate, can very easily be scheduled as an event. For example, now we can terminate all instances automatically after a training class, thereby eliminating the generation of unnecessary cost."

Behind the scenes, the portal is dramatically reducing the time required for Sage Software to replicate and fix system errors—consequently lifting overall quality and availability. "For this solution, we do not require any in-house IT support whatsoever," notes Lass. "*We estimate that the Sage Cloud Services Portal running on AWS saves our team more than 500 hours per year of server configuration time*. We are also excited by the added flexibility and potential we are achieving. Using AWS makes it possible to address projects that in the past were abandoned at an early stage due to cost reasons. Now our projects can be easily initiated thanks to the fact that for us, using AWS largely eliminates our need for expensive software and infrastructure."

Expedia Group Increases Agility and Resiliency by Going All In on AWS

2018

Expedia Group is all in on AWS, with plans to migrate 80 percent of its mission-critical apps from its on-premises data centers to the cloud in the next two to three years. By using AWS, Expedia Group has become more resilient. Expedia Group's developers have been able to innovate faster while saving the company millions of dollars. Expedia Group provides travel-booking services across its flagship site Expedia.com and about 200 other travel-booking sites around the world.

Unilever Case Study

2014

Unilever was formed in 1930 by the merger of Dutch margarine producer, Margarine Unie and British soap maker, Lever Brothers. Today, the consumer goods giant sells food, home care, refreshments, and personal care products in over 190 countries. Unilever has headquarters in London, United Kingdom and Rotterdam, the Netherlands, and subsidiaries in over 90 countries. The company employs more than 170,000 people. In 2012, Unilever reported more than €51 billion in revenue.

For Unilever, moving to the AWS Cloud improved business agility and operational efficiency. "Previously, requesting a website for a marketing campaign was a lengthy process," says Yalamanchili. "By using AWS, we improved time to launch for a digital marketing campaign from two weeks to an average of two days. That's more than seven times faster than our traditional environment. If a brand manager has an idea, he or she can implement it before the competition,"

"Using AWS saves us time," he continues. "I can simply go to the AWS website and plug in numbers to calculate costs. That makes it easy for me to set up a standard billing model for websites. It takes our partner, CSS, less than 12 hours to calculate pricing for a campaign website. I can comfortably say to my marketing folks that we have the capacity for anything we want to do. We can focus on innovation rather than infrastructure."

"The other advantage is the responsiveness of the AWS Cloud," says Yalamanchili. "By using AWS, one of the brand managers was able to completely alter a campaign within 24 hours, which wouldn't happen with the physical infrastructure."

The 10 Laws of Cloudonomics

In 2008, Joe Weinman, then Strategic Solutions Sales VP for AT&T Global Business Services, created the 10 Laws of Cloudonomics that still, are the foundation for the economics of Cloud Computing.

- **Cloudonomics Law #1:** *Utility services cost less even though they cost more*.
  Although utilities cost more when they are used, they cost nothing when they are not. Consequently, customers save money by replacing fixed infrastructure with Clouds when workloads are spiky, specifically when the peak-to-average ratio is greater than the utility premium.
- **Cloudonomics Law #2:** *On-demand trumps forecasting.*
  Forecasting is often wrong, the ability to up and down scale to meet unpredictable demand spikes allows for revenue and cost optimalities.
- **Cloudonomics Law #3:** *The peak of the sum is never greater than the sum of the peaks.*
  Enterprises deploy capacity to handle their peak demands. Under this strategy, the total capacity deployed is the sum of these individual peaks. However, since clouds can reallocate resources across many enterprises with different peak periods, a cloud needs to deploy less capacity.
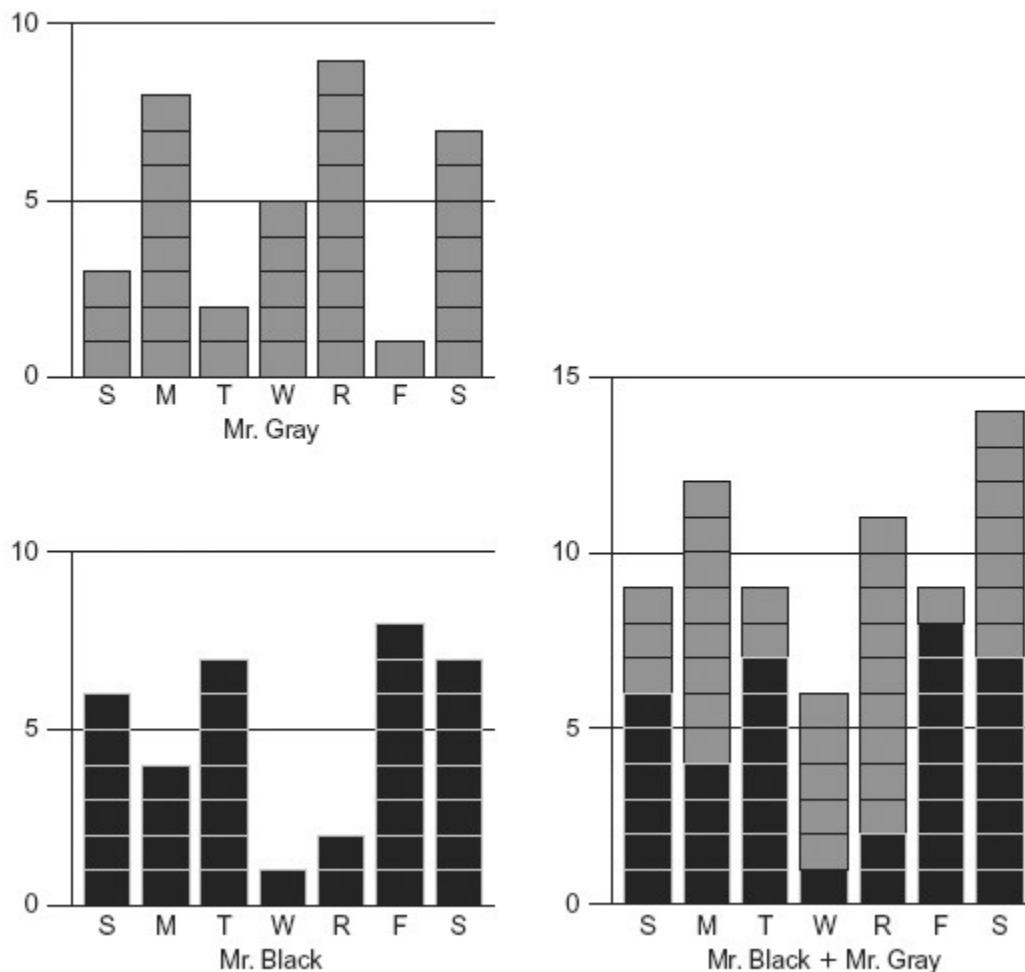
- **Cloudonomics Law #4:** *Aggregate demand is smoother than individual*.
  Aggregating demand from multiple customers tends to smooth out variation. Therefore, Clouds get higher utilization, enabling better economics.
- **Cloudonomics Law #5:** *Average unit costs are reduced.*
  They are reduced by distributing fixed costs over more units of output. Larger cloud providers can therefore achieve economies of scale.
- **Cloudonomics Law #6:** *Superiority in numbers.*
  Superiority in numbers is the most important factor in the result of a combat. Service providers have the scale to fight rogue attacks.
- **Cloudonomics Law #7:** *Space-time is a continuum.*
  Organizations derive competitive advantage from responding to changing business conditions faster than the competition. With Cloud scalability, for the same cost, a business can accelerate its information processing and decision-making.
- **Cloudonomics Law #8:** *Dispersion is the inverse square of latency*.
  Reduced latency is increasingly essential to modern applications. A Cloud Computing provider is able to provide more nodes, and hence reduced latency, than an enterprise would want to deploy.
- **Cloudonomics Law #9:** *Don't put all your eggs in one basket.*
  The reliability of a system increases with the addition of redundant, geographically dispersed components such as data centers and storage arrays. Cloud Computing vendors have the scale and diversity to do so.
- **Cloudonomics Law #10:** *An object at rest tends to stay at rest*.
  A data center is a very large object. Private data centers tend to remain in locations for reasons such as being where the company was founded, or where they got a good deal on property or a lease. A Cloud service provider can locate greenfield sites optimally and without such limits of legacy logic.