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Cloud Computing Market Maturity

Study Results



Abstract

The maturity of a product or service offering changes over time, advancing from infancy through levels of maturity before eventually reaching a plateau and decline. Cloud computing, according to participants in a 2012 study conducted jointly by the Cloud Security Alliance (CSA) and ISACA, is at the point of advancing from infancy to growth and is reaching a level of maturity at which enterprises can benefit greatly by adopting cloud infrastructure, platform or software service offerings. This report provides an understanding of the level of cloud market maturity and explores the factors that will increase growth in the market as well as those that limit acceptance and reduce the benefits that enterprises can receive from cloud computing. To enterprises involved with cloud computing, the report provides CSA's and ISACA's recommendations to address important cloud-related issues. The report also provides guidance for individuals to help them better understand cloud market maturity and how they can address those factors that inhibit their ability to realize the value of cloud computing.

Cloud Security AllianceSM

The Cloud Security Alliance (CSA) is a not-for-profit organization with a mission to promote the use of best practices for providing security assurance within Cloud Computing, and to provide education on the uses of Cloud Computing to help secure all other forms of computing. The Cloud Security Alliance is led by a broad coalition of industry practitioners, corporations, associations and other key stakeholders.

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2012 Cloud Computing Market Maturity Study Results

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Table of Contents

List of Figures.....	5
List of Tables.....	5
Cloud Market Maturity Study Highlights	6
Introduction to the Report.....	7
Defining Cloud Market Maturity	7
Survey Participants.....	8
User Perspectives on Cloud Computing	9
Cloud Market Maturity.....	12
Innovation in the Cloud	13
Forces That Influence Innovation.....	16
Confidence and Optimism in the Cloud Computing Market.....	18
Confidence Barometer	19
Service Confidence	19
Strategy Confidence	23
Problem Resolution Confidence	25
Optimism Barometer	31
Strategy Optimism	32
Problem Resolution Optimism	32
Advancing Cloud Market Maturity.....	35

List of Figures

Figure 1—Geographic Participation by Region.....	9
Figure 2—Mean Scores of Business, Financial and Environmental Factors Influencing Cloud Decisions	11
Figure 3—Cloud Services Market Maturity Stages.....	12
Figure 4—Time for Market Maturity to Reach Growth and Maturity Levels.....	12
Figure 5—Level of Cloud Market Innovation	13
Figure 6—Groups Driving Cloud Innovation	14
Figure 7—Mean Scores of Business Group Influence on Cloud Innovation.....	14
Figure 8—Market Segment Benefit and Demand for Innovation	15
Figure 9—Mean Scores of Cloud Confidence and Optimism Components.....	19

List of Tables

Table 1—Cloud Market Maturity Model	8
Table 2—Cloud Services Used and Satisfaction With Cloud	10
Table 3—Cloud Support for Business Goals	15
Table 4—Positive and Negative Influences on Cloud Adoption and Innovation.....	17
Table 5—Positive Influence Factors for Business Growth and Process Enablement.....	17
Table 6—User and Provider Perspectives on Negative Influences on Cloud Adoption and Innovation.....	18
Table 7—Confidence Barometer Summary Indicators	19
Table 8—Service Components in the Confidence Barometer.....	20
Table 9—Clarity of Concept Components in the Confidence Barometer	20
Table 10—Value Components in the Confidence Barometer	21
Table 11—Risk Components in the Confidence Barometer.....	21
Table 12—Role Definition Components in the Confidence Barometer.....	22
Table 13—Requirements Components in the Confidence Barometer	22
Table 14—Performance Monitoring Components in the Confidence Barometer	22
Table 15—Strategy Components in the Confidence Barometer	23
Table 16—Enterprise Strategy Components in the Confidence Barometer.....	23
Table 17—Strategy Components for Large and Small Enterprises in the Confidence Barometer	23
Table 18—Innovation Components in the Confidence Barometer	24
Table 19—Financial Components in the Confidence Barometer	24
Table 20—Alignment Components in the Confidence Barometer.....	25
Table 21—Customer Components in the Confidence Barometer	25
Table 22—Opportunity Components in the Confidence Barometer.....	25
Table 23—Problem Resolution Components in the Confidence Barometer	26
Table 24—Continuity and Availability Components in the Confidence Barometer	26
Table 25—Performance Components in the Confidence Barometer.....	27
Table 26—User and Provider Perspectives on Performance Components.....	27
Table 27—Problem Management Components in the Confidence Barometer	28
Table 28—User and Provider Perspectives on Problem Management Components	28
Table 29—User/Supplier Relationship Components in the Confidence Barometer	28
Table 30—User and Provider Perspectives on User-Supplier Relationship Components.....	29
Table 31—Solution Integration Components in the Confidence Barometer	29
Table 32—Security and Assurance Components in the Confidence Barometer	29
Table 33—User and Provider Perspectives on Security and Assurance Components	30
Table 34—Confidence Perspectives of Different Disciplines on Security and Assurance Components	30
Table 35—Contract Components in the Confidence Barometer	31
Table 36—User and Provider Perspectives on Contract Components	31
Table 37—Geographic Perspectives on Contract Components.....	31
Table 38—Regulation and Legislation Components in the Confidence Barometer	31
Table 39—Strategy Components in the Optimism Barometer.....	32
Table 40—Problem Resolution Components in the Optimism Barometer.....	33
Table 41—Security and Assurance Components in the Optimism Barometer.....	33
Table 42—Optimism Perspectives of Different Disciplines on Security and Assurance Components.....	34
Table 43—Items Demonstrating Positive Change From Confidence Barometer to Optimism Barometer.....	34

Cloud Market Maturity Study Highlights

This study was undertaken in the second quarter of 2012 by the Cloud Security Alliance (CSA) and ISACA to gauge the level of maturity and innovation in the cloud market, and to encourage discussions that will facilitate a better understanding of the market and the factors that encourage or constrain market maturity. The data presented were drawn from responses provided by 252 study participants representing a global community of cloud users, service providers, integrators and consultants. The interpretation of these findings is offered by CSA and ISACA as a means of synthesizing the multiple and complex concepts addressed in the study. In addition, CSA and ISACA have identified resources that can be leveraged to address issues presented in the report. It is hoped that these resources will support supplier user organizations and individuals involved with cloud computing to advance cloud computing to its full potential.

Expectations are high for cloud computing. The prevailing belief is that cloud computing can provide significant opportunities for enterprises to innovate in ways that could disrupt established ways of providing and using information technology. However, according to the participants in the CSA/ISACA survey, the cloud market has not yet reached a level of maturity that will support this scenario. Instead, the survey participants believe that platform and infrastructure service offerings are still in the infancy stage of maturity, while software service offerings are just emerging from infancy and are in the early stages of market growth. The respondents estimate that it will take approximately three years for cloud platform and infrastructure services to be firmly placed within the growth stage, and at least two years for software services to reach that stage.

Why is that important? Because it is within the growth stage of maturity that a clear understanding of what cloud computing is can be established in the market, empowering users to appreciate how it can be leveraged to provide value, what role changes in terms of accountability and responsibility need to evolve, and how enterprises can leverage cloud to benefit from supplier-user relationships. The growth stage marks cloud computing's evolution as a product, releasing supplier and user organizations to move beyond established ways of thinking about technology and information to explore new approaches that will enable them to more effectively use technology to reduce cost, open new markets and better align technology with strategic goals.

Participants in the CSA/ISACA study are optimistic about the future of cloud computing, but they are concerned that viewing cloud purely as a technology rather than as a business issue constrains cloud market maturity. The study reveals that the value of cloud is understood by the chief information officer (CIO) and technology management, and cloud risk is addressed as technology risk rather than a business unit or enterprise issue. Respondents report that board and executive management do not have a realistic understanding of cloud computing benefits or risk. In addition, it is difficult to monitor business performance, and enterprises have problems specifying business and technical risk within service contracts. For cloud to provide enterprise-changing capabilities and the benefits that vendors have promised, it needs to transition from a technology solution to a business resource, which entails understanding what cloud is and what it promises, incorporating business and technical requirements into contracts, monitoring performance against requirements, and appreciating cloud-related risk within the wider context of the business and enterprise risk management.

Participants are confident that cloud is helping enterprises become more virtualized and distributed; reduce IT cost; and optimize the use of IT resources in supporting business units, in particular by bringing new applications to market more quickly. They are less confident that cloud is driving business innovation, increasing customer satisfaction, opening new markets and increasing revenues.

These problems, as identified and discussed in the market, have the potential for limiting cloud maturity if they create the perception that issues outweigh advantages. Survey respondents viewed availability, business continuity and disaster recovery as cloud service advantages, to the extent that they are currently addressed in the market. Similarly, they are highly confident that cloud service performance, system outages and problem resolution—typical technology issues—are currently being addressed. They are less optimistic that issues such as provider longevity, an understanding of data ownership and custodian responsibilities, legal issues, contract lock-in, and exit strategies are being addressed to the same extent. They are also concerned that government regulations are not keeping pace with market changes—a significant limitation, given the weight of regulatory compliance on enterprises.

Many of the benefits promised by cloud computing vendors are linked to the interest and ability of users and providers to utilize cloud as a force of change in how technology is deployed and how technology and information are leveraged as a strategic resource. However, study participants note that cloud innovation is limited because enterprises are focusing internally rather than externally. Internally, cloud is being leveraged as a means of experimenting with new technologies and providing new services to enhance employee effectiveness and efficiency. Externally oriented goals, such as taking new ideas to market or providing best-in-class capabilities, are less often in focus.

Introduction to the Report

Cloud computing broke into the consciousness of business and technology leaders with the expectation that it would change many aspects of how technology would be acquired, managed and used. There were claims that cloud computing, as a disruptive technology, would change how enterprises would leverage information and information systems, how technology groups would acquire and support technology, and how IT departments and business units would come together to address market needs and advance strategies. Predictions rang out that chief information officers (CIOs) would evolve to become integrators of technologies, coming from within the technology organization but increasingly leveraging platforms, infrastructures and services provided through a supply chain of cloud providers. To date, these expectations describe what is still a potential, not-yet-materialized future state, due to the level of maturity within the market.

Technical innovations, even disruptive ones, must pass through various life cycle stages as they are introduced, adopted, mature and eventually decline, to be replaced by newer, more interesting and potentially more beneficial innovations. In progressing through the life cycle of infancy, growth, maturity and decline, technologies evolve and offer the potential for greater innovation to enterprises that have likewise developed the ability to adapt and leverage new capabilities and ways of interacting with information and technology. At each stage, the clarity of definition, market acceptance, potential for innovation, and level of technical and operational integration within and between enterprises and suppliers evolve. It is in the process of maturing that cloud computing's potential will be realized, advancing the ability of enterprises to trust in and extract value from cloud solutions. Cloud computing, as a disruptive technology, has the power to change enterprises. Positive change comes as service providers deliver and support truly distinctive offerings, and as enterprises integrate these offerings into programs and products successfully.

The change promised by cloud computing does not come easily. Providers need market permission and demand to be able to offer services that extend the ability of cloud users. Users need to be able to trust that services will meet their needs and provide a stable foundation on which they can build systems that enhance internal operations and provide the leverage required to better serve their stakeholders. Both providers and users need a holistic view of the current state of cloud computing. While there are many public discussions concerning cloud and its promises and limitations, these discussions are often focused on specific aspects without addressing the wider view of what cloud is and what it can do. This, however, will come with market maturity. A market maturity perspective supports the needs of users and providers to put evolving issues and concerns into context and to enable them to focus on those aspects of cloud that will encourage the continued evolution of service offerings and product use.

CSA and ISACA offer this report to provide a view into the current state of cloud computing market maturity and the factors that enhance or limit the cloud's ability to be truly disruptive, creating new opportunities for enterprises to innovate and explore ways of better using information to serve customers.

Defining Cloud Market Maturity

Market maturity can be approached from different perspectives. Maturity can be an aspect of market growth and development; within this approach, the maturity of the market is a measure of the extent to which cloud has penetrated the potential market and the revenue that is generated within the market. Maturity can be seen in terms of product evolution, the transition from a new product concept, through differentiation within the market, to productivity, and finally transparency as the capabilities of the product are fully developed and the product becomes widely accepted. Market maturity can also be described in terms borrowed from psychology, using the hierarchy of individual needs to describe product aspects such as survival, quality, convenience and customization. Finally, cloud market maturity can be explored in terms of provider and user processes because it is within processes that the ability to trust that services will provide expected value is achieved.

To examine the most important aspects of cloud computing (relations between suppliers and users, and current issues and requirements), CSA and ISACA have used a hybrid approach that addresses levels of product maturity from infancy to growth, maturity and eventual market decline. Within each stage there are particular elements that can be used to distinguish the different maturity levels. These distinguishing elements include:

- Market size and the diversity of products
- Clarity of definition and distinguishing factors between cloud and other outsourced arrangements
- Acceptance of roles and responsibilities between users and providers and within user organizations
- Level of integration between users and providers and within user organizations
- Extent of innovation in the market
- Problem resolution and the extent to which perceived problems limit adoption
- Clarity in understanding the benefits of cloud computing and the potential for an increased return on investment (ROI)

Table 1 provides an overview of the maturity levels used in this study and a description of the distinguishing elements related to each.

Table 1—Cloud Market Maturity Model	
Stage	Distinguishing Elements of the Cloud Market
Infancy	The market is small with a potential for growth and innovation that has not been realized. The definition of cloud and related roles and responsibilities is not clear. ROI is uncertain. Users and providers can be considered early adopters.
Growth	The market demonstrates significant adoption, rapid growth, and notable innovation in terms of product offerings and use. Definitions of cloud computing and how it can be leveraged are clear. Roles and responsibilities for cloud within the enterprise have evolved to address cloud’s unique aspects. Cloud computing is being integrated into core business activities. ROI is clear and examples of successful use are well known. Innovation leads to new product offerings not possible in earlier stages.
Maturity	Market growth has reached its peak. The level of innovation is slowing. New entrants have a difficult time distinguishing themselves from established service providers. Organizational roles and responsibilities are stable, as are relations between users and providers. Cloud computing is business as usual.
Decline	The cloud market is saturated with suppliers. Cloud computing is a commodity. Market leaders are clearly defined. There is little room for new entrants or new product offerings. Users and providers are looking for the next big opportunity.

Using the maturity model described in **table 1**, this report will provide insight into the following aspects of cloud computing:

- The most important factors for users in making cloud decisions
- Estimates of the current market maturity
- Innovation, including the extent to which the cloud market provides opportunities for innovation, who in organizations influences innovation, and the factors that increase and limit innovation
- The measure of confidence in cloud and contributors and detractors to that confidence
- The measure of optimism that cloud will continue to evolve, providing value, strategy alignment, innovation and revenue generation

Survey Participants

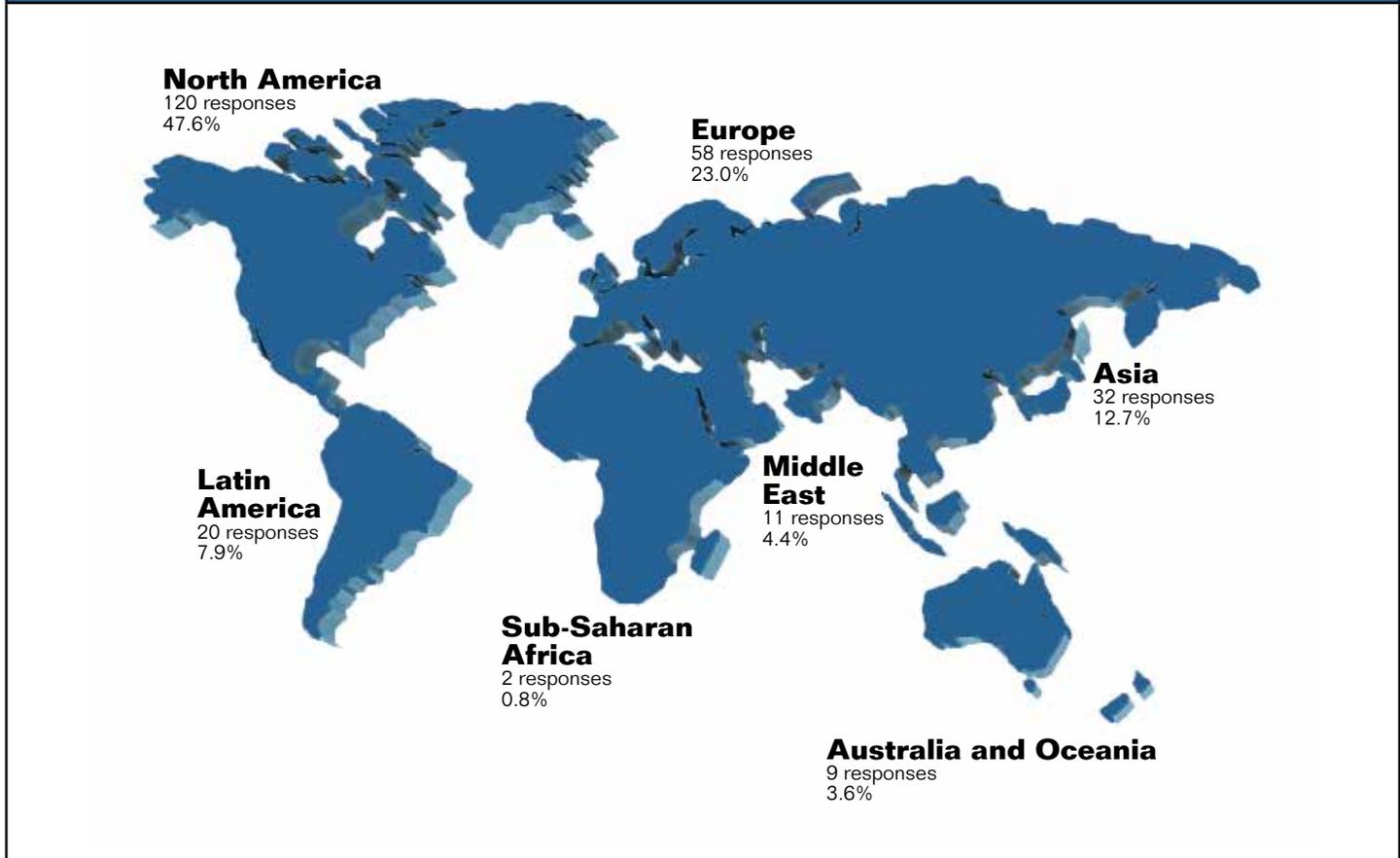
A total of 252 complete surveys were received from participants representing cloud users, providers, consultants and integrators. The participants were employed in 15 different industry segments, in positions ranging from C-level executives to staff. Forty-eight countries were represented, with the majority of respondents residing in North America or Europe (**figure 1**).

Those who contributed to the study are a diverse group. A typical participant can be described as:

- North American (120) or European (58)
- A manager (86) or vice president-level executive (70)
- Employed in an assurance role that includes specialization in information security, information systems audit, information systems risk management (129) or an information systems management or IT professional (80)
- Working in a large enterprise with more than 5,000 employees (89) or involved with cloud in a small enterprise with fewer than 100 employees (68)

Many of those who participated in the survey offer consulting or professional services (81). Other industry segments represented include technology companies (59), banking and financial services (33), government (18) and telecommunications (15).

Figure 1—Geographic Participation by Region



User Perspectives on Cloud Computing

Of the 252 participants who contributed to the study, 213 or 84.5 percent identified themselves as cloud users. It should be noted, however, that among the full survey group, 173 identify themselves as a cloud service provider, integrator or consultant as well as a cloud user, leading to an early observation from this study: The dividing line between user and provider cannot easily be drawn. Providers appear to also leverage cloud infrastructures, platforms and services to manage their business and support their customers.

The majority of users have been involved with cloud computing for at least one year. Only 15 percent of the cloud users taking part in this study have less than one year of experience with cloud. Almost 42 percent of them have two or more years of cloud experience.

The participants were asked to identify the cloud services they are currently using, their level of satisfaction with their current services and the services they expect to use in the future. **Table 2** presents a summary of current user experience with cloud computing services.

Table 2—Cloud Services Used and Satisfaction With Cloud

Cloud Service	Present Use	Level of Satisfaction
Infrastructure as a Service (IaaS)	35.7%*	<p>Not Satisfied 0 6.7%</p> <p>Slightly Satisfied 1 3.7%</p> <p>2 11.1%</p> <p>Satisfied 3 23.7%</p> <p>4 32.6%</p> <p>Highly Satisfied 5 22.2%</p> <p>Mean score = 3.39</p>
Platform as a Service (PaaS)	22.6%*	<p>Not Satisfied 0 12%</p> <p>Slightly Satisfied 1 5.6%</p> <p>2 12.9%</p> <p>Satisfied 3 26.6%</p> <p>4 27.4%</p> <p>Highly Satisfied 5 15.3%</p> <p>Mean score = 2.98</p>
Software as a Service (SaaS)	62.3%*	<p>Not Satisfied 0 2.8%</p> <p>Slightly Satisfied 1 2.2%</p> <p>2 7.8%</p> <p>Satisfied 3 24.4%</p> <p>4 39.4%</p> <p>Highly Satisfied 5 23.3%</p> <p>Mean score = 3.66</p>

* Some users reported using more than one type of cloud service.

In addition to reporting the types of services with which they have experience and their resulting satisfaction level, cloud users were asked to identify (from a supplied list) the factors that are most important to their enterprises in making cloud computing decisions. The factors listed included aspects that contribute to business enablement (e.g., elasticity of offerings, reliability and availability, quality of service, and the ability to move more quickly into markets) and financial factors (e.g., cost reduction, the ability to pay per use, opportunities for higher ROI, and the ability to turn capital expenses [CapEX] into operational expenses [OpEX]). Participants were also asked about the importance of reducing their environmental footprint as a factor that influenced their cloud decisions.

Business enablers, rather than financial considerations, dominated as the most important factors in making cloud decisions, while the least important factor is the ability to reduce the enterprise’s environmental footprint. **Figure 2** provides the list of decision-making factors and the mean response of cloud users. Responses were recorded on a range of 0 to 5, where 0 indicates that the factor has no influence. A response of 1 indicates a minimal level of influence while 5 indicates the highest level of influence in making the cloud decision.

Overall, business enablement factors were the most important influence on cloud purchase decisions. The combined mean score for business enablement was 4.08, compared to a mean score of 3.50 for financial performance and 2.67 for environmental considerations. The standard deviation, a measure of how closely responses are grouped, is 0.71 for business

enablement factors compared to 1.06 for financial performance considerations and 1.59 for reducing the environmental footprint. Not only is business enablement significantly more important to cloud users in making cloud decisions, but the group expressing this preference is more closely aligned in establishing this as a priority factor.

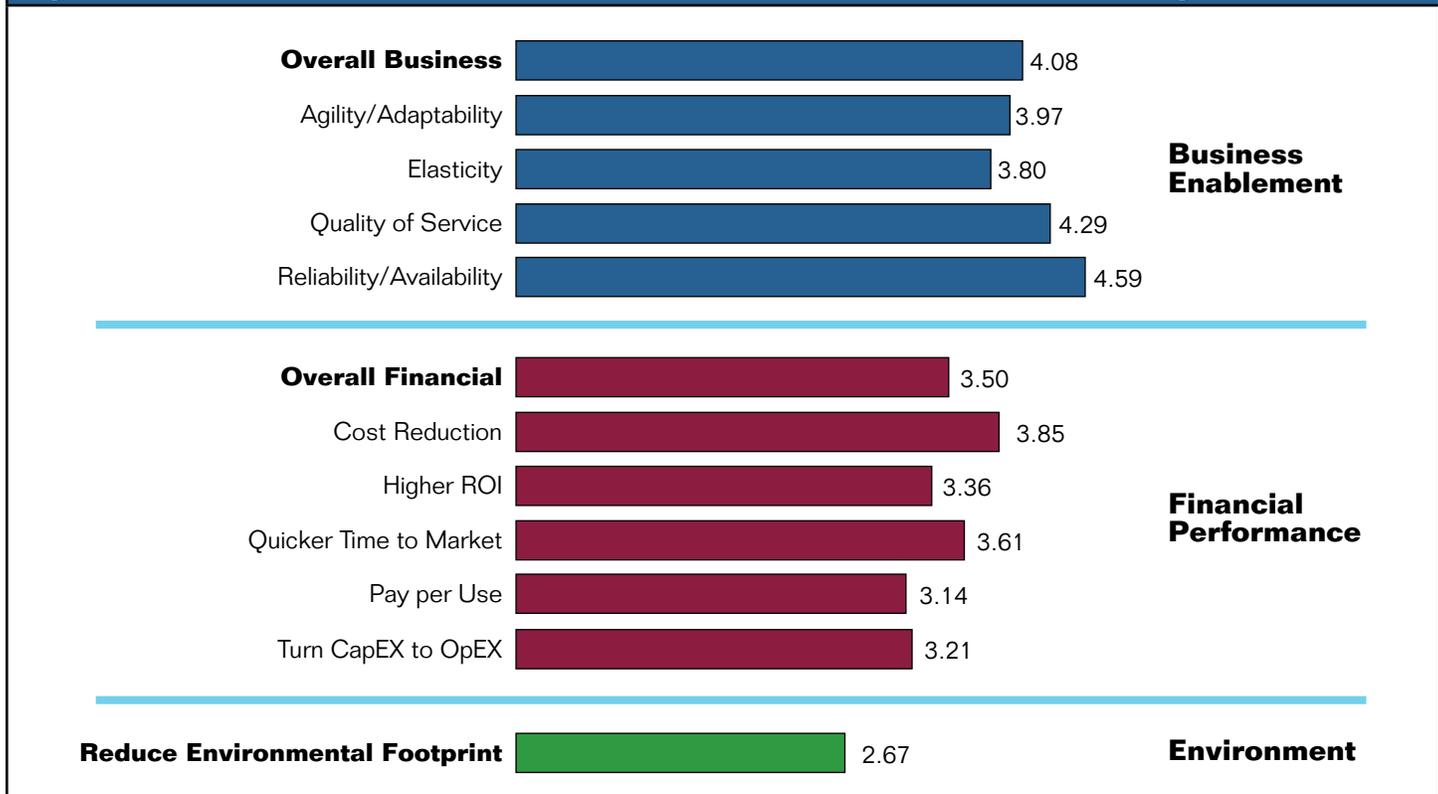
Looking at the individual business enablement factors influencing cloud computing decision making, the most important factors are related to the reliability and availability of services (mean score 4.59) and quality of service (mean score 4.29). This implies a feeling of uncertainty concerning cloud computing that is consistent with cloud being seen as a new and not entirely mature service offering. Users selected those characteristics of cloud that large and well-established cloud vendors offer when they enter the market as cloud service providers. These vendors are reasonably expected to bring reliability and availability as a core part of the service.

It is more difficult to ensure agility and elasticity because these are dependent not only on the supplier offering the service, but also on the user who needs to make the service work within the enterprise. Nevertheless, agility and adaptability (mean score 3.97) and elasticity (mean score 3.80) are other business enablement factors rated as important in making cloud decisions. It is interesting that reliability, availability, agility and elasticity are fundamental components of what cloud computing offers to enterprises; their top ranking by the participants who use cloud services supports the notion that users are more focused on general issues than specific elements unique to cloud.

Of the financial factors, the most significant for users in making cloud decisions is cost reduction (mean score 3.85), which is the only financial factor within the top five decision-making considerations. Quicker time to market (mean score 3.61) and obtaining a higher ROI (mean score 3.36) are the most important financial factors following cost reduction. Financial factors that are foundational aspects of cloud computing, such as turning capital expenses into operational expenses (mean score 3.21) and the ability to meter and pay for only those services that are used (mean score 3.14), are important but less significant than traditional decision-making financial factors.

Business enablement factors figure more prominently in making cloud purchase decisions than do financial factors.

Figure 2—Mean Scores of Business, Financial and Environmental Factors Influencing Cloud Decisions

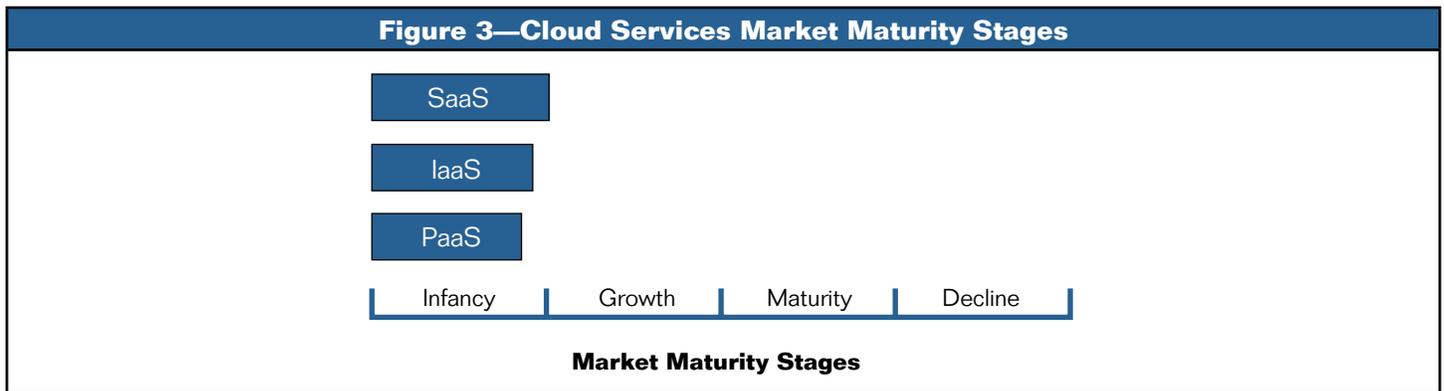


Cloud Market Maturity

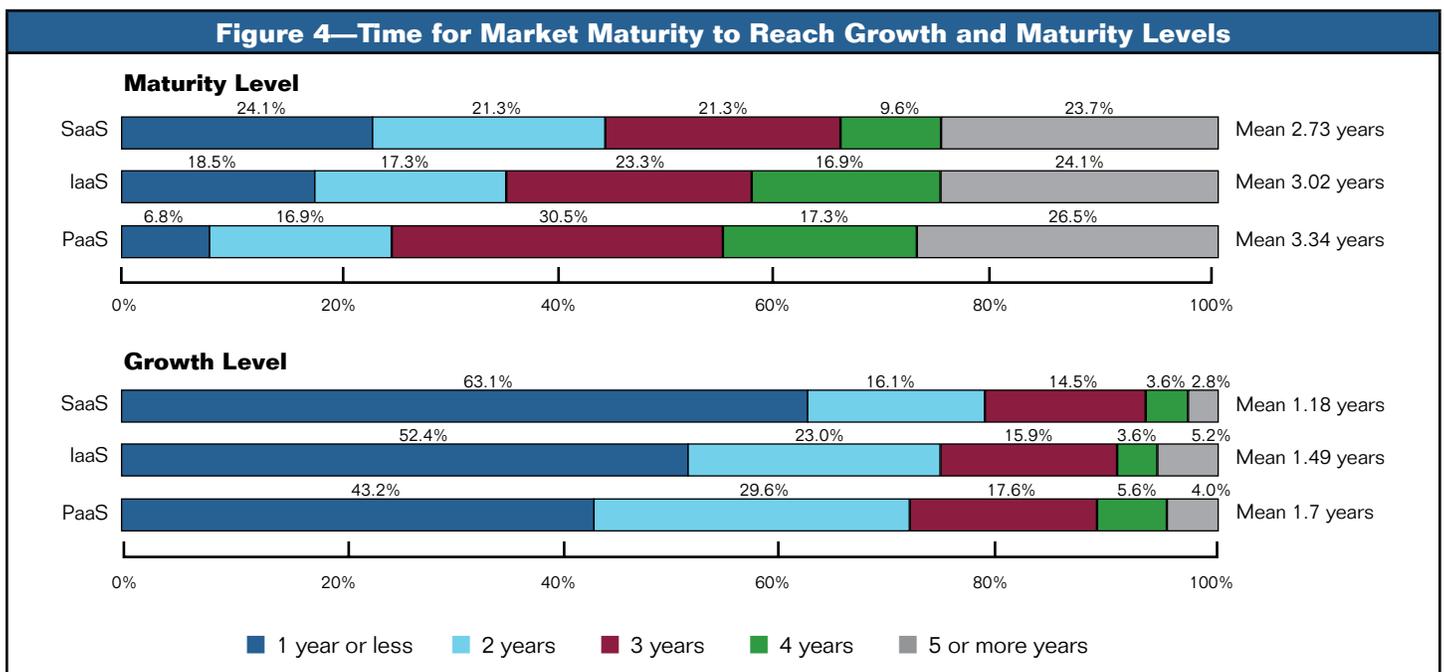
Overall, those taking part in the study consider cloud computing a relatively immature service offering. When asked to identify the current level of cloud market maturity they placed only SaaS in the earliest stage of the growth level. Both IaaS and PaaS were positioned at the middle to upper level of market infancy (figure 3).

The placement of cloud as a whole solidly at the infancy level of maturity and SaaS in early growth has significant implications for users and providers. In terms of the elements of maturity—innovation, market saturation, value to business, clarity of definition, clarity of roles, accountability and responsibility between users and providers, and the ability to extract value—cloud computing has a way to go before it delivers on promised results.

Because cloud is in its infancy, a clear understanding of what it is, outside of general definitions, does not yet exist. In spite of expectations that cloud will redefine relationships between technology and business units and consequently the role of the CIO will change, these outcomes remain in the category of future predictions—not yet reality. Evolution is still to occur with regard to cloud-related roles and responsibilities, accountabilities and responsibilities, relations between business and technology groups, and how information and information technology support the cloud strategy. These concepts are further explored in the portion of this report dealing with measures of confidence and optimism relative to cloud.



Study participants were asked to identify the point in the future when cloud would reach levels of growth, maturity and decline. Respondents could indicate that the service is already at a particular maturity level or estimate the number of years (from one to five or more) it would take for the service to reach the specific maturity level. Results are shown in figure 4.



In each case, the time required to get to the level of maturity is less for SaaS than it is for IaaS or PaaS. As indicated in **figure 4**, participants estimated that IaaS and PaaS will not reach the growth stage for almost two years. Their estimates indicate that at least one year will elapse before SaaS will be solidly within the growth maturity level.

Innovation in the Cloud

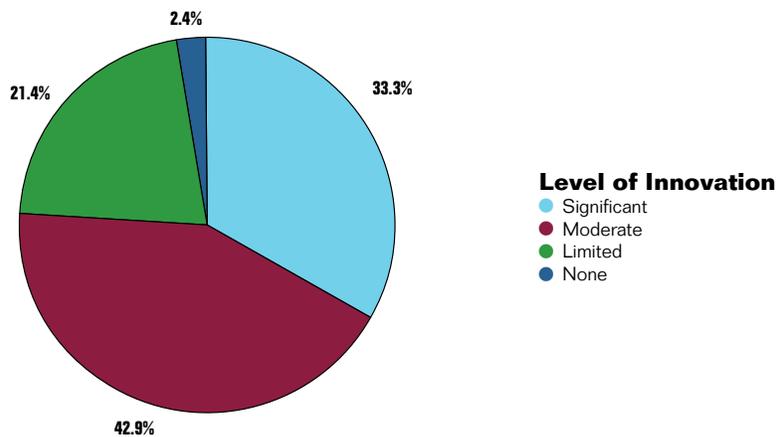
Innovation should provide the foundation for enterprises as they explore different and more effective ways of using technology to expand the business and increase profits. For cloud computing to be truly disruptive, it must challenge how enterprises think about technology and information and how technology can be exploited to achieve better outcomes. Innovation is about using cloud to work differently, provide new information resources and capabilities for internal knowledge workers, and enable enterprises to strengthen relationships with customers and meet their needs in new and engaging ways.

The overwhelming opinion among the 252 individuals who took part in this study is that there is a moderate level of innovation in the current cloud market (**figure 5**).

Forty-three percent selected that option, while 24 percent indicated that there are none or limited levels of innovation in the market and 33 percent considered the level of innovation in terms of products, services and business use as significant. Service providers feel the same: The majority perceived at least a moderate level of innovation by providers and users. Within the user community, 27 percent noted a significant amount of innovation by businesses, and almost 20 percent saw a significant level of innovation within the supplier market.

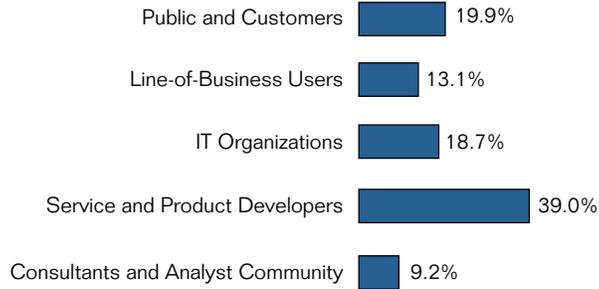
While service and product developers are seen as driving cloud innovation, it is the CIO and IT management who represent the greatest influence on innovation.

Figure 5—Level of Cloud Market Innovation



Cloud computing is both a commercial offering and a business enabler. From each market segment—customers, business line management, technology organizations and suppliers—can come different demands for innovation within the cloud market. From the survey, it appears that service and product developers have the greatest impact on innovation. When asked to identify who is currently driving cloud innovation, 39 percent of participants pointed to service and product developers as leading the charge (**figure 6**). The public and customers, line-of-business users, and IT organizations also appear to contribute to driving innovation, with only consultants and the analyst community seen as not having a significant impact. This is somewhat surprising because analysts typically influence market innovation by reporting leading market trends and highlighting significant areas for business performance improvement. In the same manner, consultants typically encourage innovation in enterprises by recommending practices that challenge existing behaviors, organizational structures and business solutions.

Figure 6—Groups Driving Cloud Innovation



Understanding that service and product developers are playing a significant role in driving cloud innovation provides only part of the answer to innovation. It is equally important to understand where the force encouraging this innovation is coming from and what desired outcome is expected. When asked about business demand for supplier innovation, 32 percent of study participants indicated at least a moderate demand by user organizations, while slightly more (39 percent) reported a significant level of demand.

To further explore the driving force for cloud innovation, survey takers were asked to rate several groups' influence on cloud innovation on a scale from 0 (no influence) to 5 (significant influence). As illustrated in **figure 7**, the strongest influence originated from IT management and staff (mean score 3.84), followed by the CIO and senior business executives (mean score 3.36) and business unit management (mean score 3.18). These results are interesting because they seem to contradict a commonly held belief that business unit leaders are the driving force for cloud use and innovation while IT is sometimes left out of the decision-making process only to become involved after decisions are made and contracts signed. This survey indicates that technology organizations and the CIO significantly influence cloud innovation.

Figure 7—Mean Scores of Business Group Influence on Cloud Innovation



Based on the millions of words that have been written about what cloud computing can provide to enterprises and how it can enhance innovation, there are many expectations of cloud computing, which ultimately influence the direction and need for cloud innovation. Participants in the study were provided a list of potential outcomes and asked to indicate the extent to which each was achieved through the use of cloud computing (see **table 3**). These outcomes included:

- Gaining access to new technologies without having to invest in acquiring the technology
- Providing new and engaging ways of working with and supporting customers
- Enhancing worker effectiveness and efficiency by providing new tools and services
- Creating new ideas and bringing them to market more quickly
- Enabling better outcomes by providing best-in-class tools and capabilities

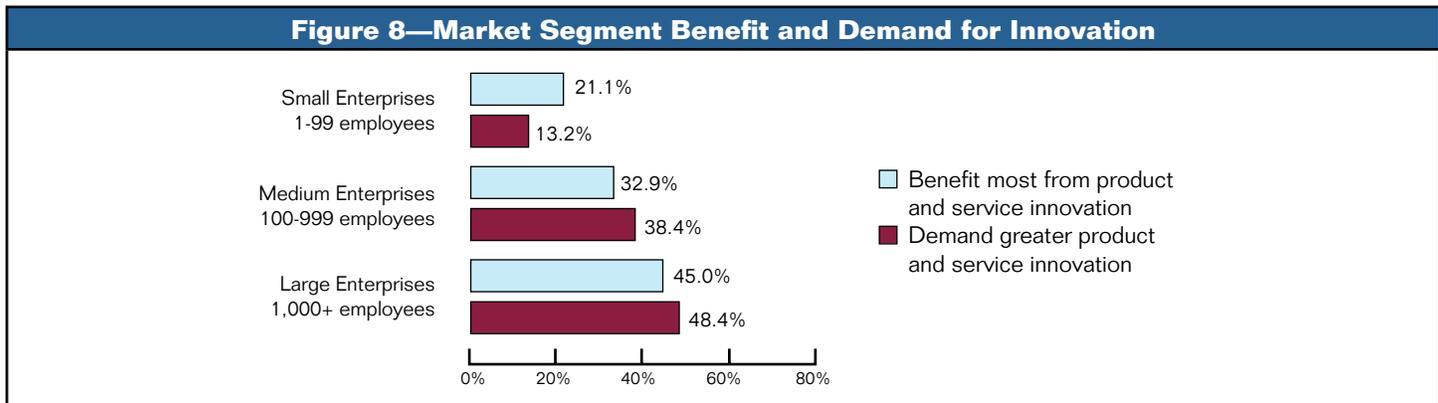
Experimenting with new technologies and providing new services to enhance worker effectiveness and efficiency share top ranking among the outcomes that cloud computing helps to achieve (mean score 3.58). These both appear to have a more internal enterprise focus than do other outcomes listed, such as using cloud to engage with customers or taking new ideas to the market. Gaining access to best-in-class tools and capabilities could be considered to have both an internal and an external focus.

While experimenting with new technologies and providing new services to increase worker effectiveness and efficiency are ranked first, it is interesting to consider the strength of agreement with the statements. Since each question was presented on a scale of 0 to 5, a mean score of 3.58 represents only a moderate, less than significant, level of agreement. Perhaps cloud computing contributes more integrally to other outcomes that were not included in the study. Or, perhaps there is only a moderate feeling that cloud computing is playing a major role in achieving these outcomes. The standard deviation provides an indication of the consistency of responses. The standard deviation for both of the top-ranking options demonstrates a wide range of responses from those who participated in the study, indicating a lack of strong consensus. The moderate level of agreement and the spread of responses seem to support the idea that cloud computing is, at best, in the infancy level of market maturity. If cloud were a more mature offering, it would be clearer which outcomes are being supported by it. There would be a stronger level of agreement among respondents.

Internal requirements such as experimenting with new technologies and providing new services to enhance worker effectiveness and efficiency are primary outcomes of cloud computing adoption.

Goal	Rank	Mean Score
Experiment with new technologies	1	3.58
Provide new services to enhance worker effectiveness and efficiency	1	3.58
Experiment with new ways of engaging with customers	2	3.53
Take new ideas to market	3	3.43
Provide access to best-in-class tools and capabilities	4	3.25

Cloud computing provides opportunities to innovate for many types and sizes of enterprise. It seems logical that small and medium enterprises would adopt cloud to avoid the difficulties and expenses of building an IT infrastructure to manage the business and serve customers. Large enterprises can also benefit from cloud by taking advantage of opportunities to experiment with technologies without having to invest in their procurement and deployment. Survey participants believe that large enterprises (more than 1,000 employees) demand more product and service innovation than smaller enterprises and benefit more from it as well. Demand for and benefit from innovation seem to align with size, with large enterprises evidencing the most, then medium enterprises (100-999 employees), and finally small enterprises (fewer than 100 employees) evidencing the least (**figure 8**).



Forces That Influence Innovation

The decision to adopt what could be considered a disruptive technology must address and resolve both encouraging and discouraging factors. While they are in their infancy, disruptive technologies may move more slowly toward adoption because of the unbalanced weight of perceived negative over positive factors and their impact on expected benefits. With maturity comes greater visibility of the positive aspects of the technology. Potential problems and limitations are minimized, solutions are found, and benefits take on greater importance in decision making.

There are many motivators that encourage enterprises to decide to innovate using cloud infrastructure, platform or software services. These motivators include the ability to better manage cost, improve customer service, meet internal and external demands, and leverage technology to enter new markets more quickly. However, there are also discouraging factors that could limit adoption. They include concerns for information security, legal and contractual complications, difficulties meeting regulatory requirements, and fear that suppliers may not be able to deliver on promised services.

Study participants were provided a list of 11 factors that are tightly connected to what cloud is and what it promises and asked to rate (on a scale of 0, no influence, to 5, significant influence) how well each positively influences the decision to adopt cloud innovation. Participants were also asked to review a provided list of 11 commonly held concerns related to cloud computing and rate (on the same 0 to 5 scale) the degree to which they may negatively influence an enterprise's decision to adopt and use cloud to innovate. **Table 4** presents the mean score and ranking for each factor.

Among the limiting factors, security and data ownership (both related to the ability to protect information assets) and factors related to legal issues, contracts and regulatory compliance topped the list. The fifth factor, information assurance, is significant because it is related to the transparency of cloud offerings and management's ability to gain comfort that information is protected to the required degree. Among the factors considered to most influence cloud adoption and innovation areas which could be considered as most related to innovation, access to new technologies, meeting changing customer demand, use of technical resources, and entering new markets were the lowest items in the ranking suggesting that time tested basic business issues such as maintaining cost, efficiency and productivity are most significant in forming decisions to adopt cloud solutions.

When a disruptive technology such as cloud computing is first introduced, factors that limit adoption can provide a strong negative effect on the market. As the product or technology matures, evolves and is further clarified, it gains wider acceptance, use is encouraged and greater innovation follows. Cloud will surely follow this same path, ultimately leading to offerings that truly disrupt established ways of using and deploying technology and leveraging information assets. As illustrated in **table 4**, the mean scores for the factors that encourage and limit adoption have almost reached equilibrium although limitations are still a larger concern. While no previous study exists to provide comparative data on positive and negative influences, the nearly equal mean scores of the opposing factors support the notion that limiting factors may no longer hold enterprises back from adopting cloud for business innovation.

An imbalance in perceived risk over promised benefits influences cloud adoption decisions.

Table 4—Positive and Negative Influences on Cloud Adoption and Innovation

Positive Influence on Cloud Adoption/Innovation	Mean Score	Rank	Negative Influence on Cloud Adoption/Innovation	Mean Score	Rank
Cost management	3.77	1	Information security	4.22	1
Agility	3.75	2	Data ownership/custodian responsibilities	4.12	2
Time to market	3.73	3	Legal and contractual issues	4.04	3
Efficiency	3.65	4	Regulatory compliance	4.01	4
Productivity	3.61	5	Information assurance	3.77	5
Business unit demand	3.55	6	Longevity of suppliers	3.44	6
Resilience	3.52	7	Contract lock-in	3.42	7
New technology	3.46	8	Performance standards	3.30	8
Customer demand	3.42	9	Disaster recovery/business continuity	3.25	9
Technical resources	3.37	10	Performance monitoring	3.21	10
New markets	3.33	11	Technology stability	3.10	11
Summary Mean	3.56		Summary Mean	3.62	

The 11 factors that positively influence cloud adoption and innovation support growth or process enhancement. The study participants rated the factors in the two general categories as almost equally important in influencing cloud adoption and innovation. **Table 5** lists these factors and provides their ranking and position in supporting business growth or process enhancement.

Table 5—Positive Influence Factors for Business Growth and Process Enablement

Business Growth Influence	Mean Score	Rank	Process Enhancement Influence	Mean Score	Rank
Agility	3.75	1	Cost management	3.77	1
Time to market	3.73	2	Efficiency	3.65	2
Business unit demand	3.55	3	Productivity	3.61	3
New technology	3.46	4	Resilience	3.52	4
Customer demand	3.42	5	Technical resources	3.37	5
New markets	3.33	6			
Summary Mean	3.54		Summary Mean	3.59	

Users and providers hold different opinions of the 11 factors that negatively influence cloud adoption and use (**table 6**). Users evidence a more cautionary perspective than providers, as illustrated by a comparison of the mean scores. Although the scores of the users (overall mean score 3.76) and the providers (overall mean score 3.51) are not widely divergent, they do reflect a difference in perspective. Most notable in this regard is the result relating to disaster recovery and business continuity; users reported a more negative perspective, ranking it as the eighth most limiting factor as compared to the providers, who ranked it tenth. Users also saw contract lock-in as being a more limiting factor. Not surprisingly, providers saw this as a less significant negative influence on cloud adoption.

Table 6—User and Provider Perspectives on Negative Influences on Cloud Adoption and Innovation

Negative Influence on Cloud Adoption/Innovation	User Perspective		Provider Perspective	
	Mean Score	Rank	Mean Score	Rank
Information security	4.23	1	4.21	1
Data ownership/custodian responsibilities	4.18	2	4.09	2
Regulatory compliance	4.05	3	3.99	4
Legal and contractual issues	4.04	4	4.05	3
Information assurance	3.87	5	3.73	5
Contract lock-in	3.50	6	3.39	7
Longevity of suppliers	3.50	7	3.41	6
Disaster recovery/business continuity	3.47	8	3.16	10
Performance standards	3.40	9	3.25	8
Performance monitoring	3.32	10	3.16	9
Technology stability	3.14	11	3.09	11
Summary Means	3.76		3.51	

Confidence and Optimism in the Cloud Computing Market

Cloud market maturity is a reflection or outcome of many things:

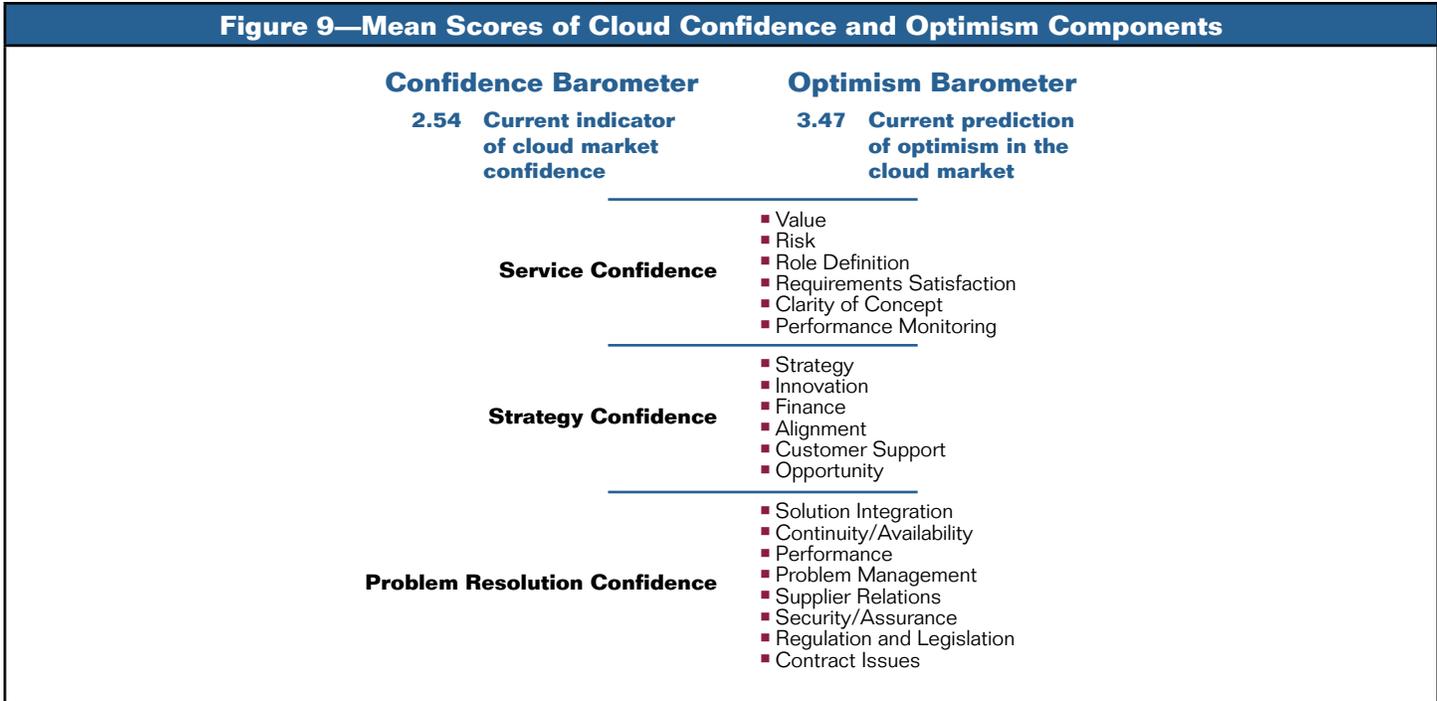
- User and provider perspectives on the state of cloud computing
- Innovation by those who deliver services and those who use them
- How clearly cloud computing is defined and understood
- How roles and responsibilities are defined and the extent to which they are accepted within the market
- Forces that limit adoption and use
- Evolving confidence that cloud services will enable new relationships and have a positive impact on enterprises

Confidence, as a current measure, must be supported by optimism for the future. Without a belief that current limitations can be overcome and concerns will be resolved, cloud computing will not be able to progress into levels of maturity at which exceptional value is not only promised, but also delivered.

To gain insight into cloud confidence and optimism, three series of statements about cloud computing features and issues were presented to the study participants and they were asked to rate their level of agreement with each (on a scale from 0, no agreement, to 5, full agreement). The higher the rating, the greater the respondent’s level of confidence that cloud issues are currently being addressed.

The first series of statements addressed important service-related issues such as value capture, how risk is addressed, role definition and acceptance, the extent to which requirements are met, and how effectively performance is monitored by users and providers. Similar series of statements related to strategy and problem resolution were also presented to survey participants for rating.

The responses to the three series of statements were grouped into higher-level descriptors and rolled up into a summary confidence barometer. In addition, survey participants were asked to rate their level of confidence that each service, strategy and problem resolution issue would be addressed in the future. This future-oriented measure is termed “optimism” (figure 9).



The responses revealed that there is a guarded level of current confidence that cloud can deliver on promises and issues and that concerns are being addressed. There is greater optimism that issues and concerns will be addressed and resolved in the future.

Confidence Barometer

The market is moderately confident that cloud services are meeting service and strategy expectations and problems are being addressed. The confidence barometer brings together 60 different measures grouped into the three categories (service, strategy and problem resolution). As indicated in **table 7**, the level of confidence on the 0 (no confidence) to 5 (full confidence) scale hovers near the midpoint for each of the three indicator measures and overall.

Confidence Indicator	Mean Score
Service Confidence	2.19
Strategy Confidence	3.04
Problem Resolution Confidence	2.38
Confidence Barometer	2.54

Service Confidence

The first six elements incorporated into the confidence barometer are drawn from 16 statements about cloud computing service features and issues, about which survey participants were asked to indicate their degree of agreement (on a scale of 0, no agreement, to 5, full agreement). Based on the way the statements were written, a higher agreement rating implies a higher degree of confidence that the issue is currently being addressed. The statements touched on essential elements of cloud services, including:

- The perceived value of cloud to internal business audiences
- How cloud risk is addressed
- Role definitions between suppliers and users
- Cloud requirements and service level agreements
- The clarity of cloud concept in enterprises
- Performance monitoring

The overall confidence level for the six service elements is 2.19. The service elements, their mean scores and their rankings are presented in **table 8**.

Table 8—Service Components in the Confidence Barometer		
Service Component	Mean Score	Rank
Value	2.45	1
Risk	2.22	2
Role definition	2.16	3
Requirements	2.12	4
Clarity of concept	2.08	5
Performance monitoring	1.95	6
Overall	2.19	

Clarity of Concept

Having a clear and commonly understood definition of cloud computing is fundamental to being able to benefit from cloud service offerings. While the clarity of cloud concepts is not the highest ranking among the six service components, it is addressed first since the other service components are dependent on the clarity of the cloud computing concept in the market.

For cloud computing to gain wider acceptance and fully enter into the growth stage of market maturity, cloud concepts must be clearly understood and differentiated from other outsourcing arrangements. If cloud computing is perceived as just a newer version of outsourcing, then the unique benefit that has been ascribed to cloud cannot be achieved. Clarity of concept, which has an overall mean score of 2.08, includes measures relating to cloud as a technology being clearly defined and understood, and cloud products and services being clearly distinguished from outsourced offerings.

Responses indicate that cloud is not currently distinguished from outsourcing in the market, nor is cloud in general clearly defined and understood (**table 9**). Differentiation from outsourcing seems to be especially misunderstood; that statement ranked 11th among the 16 service-related statements presented for rating.

Table 9—Clarity of Concept Components in the Confidence Barometer	
Clarity of Concept Component	Mean Score
Cloud computing as a technology is clearly defined and understood.	2.12
Cloud products and services are clearly distinguished from other outsourced offerings.	2.05
Overall	2.08

Value

If having a common definition of cloud presents a challenge, then it would seem even more difficult to foster understanding of the value cloud brings. However, understanding the value of cloud to the enterprise received the highest confidence rating among the six service confidence measures (see **table 8**). In this case, though, top ranking does not equate to a high score; its mean score was only 2.45, under the midpoint on the confidence scale.

The value category includes measures of clarity on the value of cloud computing by executive management, business unit management, and the CIO and technology management. In a previous section of this publication it was reported that cloud innovation is led by the technology management and staff and that the CIO and senior business executives play a secondary role. Therefore, it could reasonably be expected that the CIO and technology management in enterprises would better understand the value that cloud brings. In fact, of the three value indicators (**table 10**), the CIO and technology management group has a mean score of 3.10 on a scale of 0 to 5, indicating strong consensus among participants. Between the other two groups, participants believe that business unit leaders (mean score 2.23) outstrip executive management (mean score 2.04) in their understanding of the value of cloud. The relatively low score for executive management indicates a troubling consensus that there is a potential deficit in understanding of cloud value within the very group that needs that understanding in order for their enterprises to capture the full benefits. If cloud is truly a disruptive technology, then the board and executive management must understand how to exploit its transformative capabilities.

Table 10—Value Components in the Confidence Barometer

Value Component	Mean Score
The value of cloud to the business is clearly understood by the CIO and technology management.	3.10
The value of cloud to the business is clearly understood by business unit management.	2.23
The value of cloud to the business is clearly understood by executive management.	2.04
Overall	2.45

Risk

A deficit in understanding the value cloud promises implies a difficulty in properly addressing the risk cloud introduces. Three risk-related statements were included in the survey for participant rating:

- Treating cloud-related business risk as part of enterprise risk management
- Addressing technical cloud risk as part of business unit risk
- Addressing technical cloud risk as part of technical risk

The survey responses indicate that cloud computing is most often addressed as a technology-related risk (**table 11**). This may be consistent with leadership in cloud and a clearer understanding of the value of cloud residing within the technology organization. The value of cloud and risk related to cloud can be considered two sides of the same coin because taking a risk is required for enterprises to receive value.

There is not so much agreement that cloud risk should be addressed as a business risk and even less that cloud should be addressed as part of the enterprise risk program. Treating cloud risk as a technology risk—without considering the risk to the business unit or to the enterprise—demonstrates the narrow thinking many enterprises display around cloud computing. If cloud is addressed only as a technology, then the true value that cloud can bring will be missed and opportunities for true innovation lost. More flexible thinking about cloud is needed enterprisewide, to understand what it is, what value it brings, and what risk is associated with new ways of managing and using information and information technology. From an enterprise view, the board needs to develop a firm understanding of cloud, articulate a vision of cloud benefits, and communicate risk down into business units and technology departments.

Table 11—Risk Components in the Confidence Barometer

Risk Component	Mean Score
Technical risk relative to cloud computing is considered a part of technical risk management.	2.71
Business risk relative to cloud computing is considered as part of enterprise risk management.	2.30
Technical risk relative to cloud computing is considered as part of business unit risk management.	2.25
Board and executive management make business decisions concerning cloud computing based on a realistic understanding of risk.	1.65
Overall	2.22

Role Definition

The clear assignment and acceptance of roles and responsibilities within enterprises and with service providers is essential. Yet, for cloud computing, there is little agreement that IT, supplier, user enterprises, and business unit roles and responsibilities are clearly defined and coordinated (**table 12**). The failure to define where responsibility and accountability are placed provides opportunities for confusion under the best conditions. A crisis can result from even simple incidents when responsibilities are not clearly understood. This is a problem between suppliers and users, but it is even more significant when IT and business units have not come to an agreement as to who is responsible for aspects of cloud relationship and solution management.

Table 12—Role Definition Components in the Confidence Barometer

Role Definition Component	Mean Score
IT staff roles and responsibilities are clearly defined and coordinated.	2.28
Supplier and user roles and responsibilities are clearly defined and coordinated.	2.12
Roles and responsibilities between business units and IT are clearly defined and coordinated.	2.08
Overall	2.16

Requirements

Business requirements need to be identified and incorporated into contracts and service level agreements. Both of these concepts were addressed within the survey. For the statement on how well business and technical requirements are incorporated into contracts, responses indicate inadequate incorporation of requirements into agreements (**table 13**).

The study did not differentiate between business requirements and technical requirements in the statement regarding contracts. However, it may be assumed—based on the deeper understanding of cloud by the CIO and technology management and the predilection for treating cloud risk as a technical issue—that technical requirements are better understood than business requirements. Supporting this is the participants' response to the statement that service level requirements are clearly defined. That statement's mean score is 2.23, a higher level of agreement than for contracts, at a mean score of 2.02, but hardly a resounding vote of confidence that technical requirements are clearly understood or incorporated in some manner in service level agreements. Service level agreements are the basis for describing and enforcing user expectations relative to cloud, documenting what providers will offer, and enforcing the terms of the user-provider agreement. If business and technical requirements are not well documented and service level agreements are not well defined, then the basis of the relationship between providers and users may be in peril.

Table 13—Requirements Components in the Confidence Barometer

Requirements Component	Mean Score
Service level requirements are clearly defined.	2.23
Business and technical requirements are clearly defined and incorporated into contracts.	2.02
Overall	2.12

Performance Monitoring

Of the 16 cloud service indicators included in the study, the items related to performance monitoring ranked lowest in terms of agreement. Yet one item—that service providers effectively monitor and report against service level requirements—is an essential part of forming a working user-provider relationship. Its low rating (mean score 2.02) by the participants indicates a troublingly low degree of confidence that providers effectively monitor performance against service level requirements.

Agreement with another statement—that users monitor provider performance against service level agreements—is even lower (1.88). The overall mean score is 1.95, the lowest among the six service-specific items (**table 14**). This indicates a potentially serious problem for both providers and users since performance monitoring is an essential part of cloud service effectiveness.

Table 14—Performance Monitoring Components in the Confidence Barometer

Performance Monitoring Component	Mean Score
Service providers effectively monitor and report against service level requirements.	2.02
Users monitor provider performance against service level agreements.	1.88
Overall	1.95

Combined, these service-specific measures present a significant indicator of the level of maturity within the cloud computing market. The maturing of the cloud market is dependent on several factors:

- The clarity of cloud concepts
- An understanding of roles and responsibilities
- An appreciation for the value that cloud can bring and clarity on how risk is addressed on an enterprise level
- Effective documentation of expectations in agreements
- The ability to ensure compliance with agreed-on performance expectations

Based on the less-than-robust confidence levels assigned to these service factors by survey participants, cloud computing has to evolve significantly before it can reach a higher level of maturity. The failures to define cloud, understand value, address risk, document requirements and monitor performance are characteristic of a new product entry into a market. Until these issues are addressed, cloud cannot move to the level of general acceptance that accrues to the growth level of market maturity.

Strategy Confidence

The second component of the confidence barometer, demonstrating strategy confidence, includes 16 items combined into six measures indicating the extent that cloud meets expectations concerning strategy alignment, innovation, financial considerations, business and IT alignment, customer satisfaction and opportunity achievement (table 15).

Table 15—Strategy Components in the Confidence Barometer		
Strategy Component	Mean Score	Rank
Enterprise strategy	3.16	1
Innovation	3.05	2
Finance	3.05	2
Alignment	3.01	3
Customer	2.92	4
Opportunity	2.82	5
Overall	3.03	

Enterprise Strategy

Strategy in relation to meeting expectations is a combination of general and specific measures: cloud’s ability to support the business strategy (general) and its ability to bring new applications to market more quickly (specific). The more general measure—the ability to support the business strategy—received mild consensus among study participants, scoring a 3.08 on the 0 to 5 scale, indicating that respondents are hovering between feeling that cloud only minimally meets expectations and it significantly meets expectations (table 16). The more specific indicator of strategy success—moving new applications to market more quickly—received a slightly more positive mean score (3.23). This would seem to indicate that enterprises are achieving strategy success to a greater extent in leveraging cloud for new application development and bringing new applications to market sooner. This question ranked second among the 16 general strategy confidence measures for all survey takers.

The responses of users and suppliers were about the same, supporting the industrywide consensus that cloud is helping enterprises to introduce new applications more quickly, an important component of what cloud promises.

Table 16—Enterprise Strategy Components in the Confidence Barometer	
Enterprise Strategy Component	Mean Score
Bring new applications to market faster	3.23
Support the business strategy	3.08
Overall	3.16

It might be expected that small enterprises would be more inclined than large enterprises to leverage cloud to provide applications for internal use and customer engagement, and the survey results support this expectation (table 17). Bringing new applications to market ranks second for enterprises with fewer than 100 employees (mean score 3.34) and fourth for enterprises with more than 5,000 employees (mean score 3.17). It is interesting to note there was less consensus among study participants that midsize enterprises (100 to 4,999 employees) can leverage cloud for bringing applications to market more quickly. This middle group of enterprises ranks this element ninth, with a mean score of 3.23.

Table 17—Strategy Components for Large and Small Enterprises in the Confidence Barometer		
Strategy Component	Small Enterprise Mean Score	Large Enterprise Mean Score
Bring new applications to market faster	3.34	3.17
Support the business strategy	3.16	2.92

Innovation

The innovation topic includes four capabilities that can be characterized as relating to innovation:

- The ability of cloud to drive technical innovation
- The ability of cloud to drive business innovation
- The ability of cloud to increase business innovation
- The ability of cloud to transform the enterprise

Participants in the study are more confident that cloud meets expectations related to driving technical innovation over business innovation. In the order of confidence for the 16 strategy components, the ability of cloud to drive technical innovation is ranked fourth (mean score 3.17) while driving business innovation is ranked eighth (mean score 2.96). The ability to drive innovation positions cloud as a force that moves an enterprise toward a certain outcome. It appears easier for cloud computing, as a driver for innovation, to be a force for change within the technical environment than it is for cloud to change the business.

While cloud computing may not cause business innovation, it can be used as a tool to foster innovation in the business. However, study participants ranked the ability of cloud to increase business innovation even lower than its role in causing business innovation. Finally, the degree of agreement that cloud computing can be expected to transform the enterprise is roughly the same as the confidence that it can drive or increase business innovation (table 18). This may again be consistent with the feeling that cloud computing is a technology solution for business problems. As such, it would be less capable of bringing about the wide changes that are required to transform an enterprise.

Table 18—Innovation Components in the Confidence Barometer

Innovation Component	Mean Score
Drive technical innovation	3.17
Increase business innovation	3.16
Drive business innovation	2.96
Transform the enterprise	2.96
Overall	3.05

Finance

Financial benefits are among the expected outcomes of cloud computing services. As part of the study, participants were asked to indicate their level of agreement that cloud could reduce cost and increase business results in terms of sales. The ability to reduce cost ranked first among the full list of 16 strategy elements (mean score 3.26) indicating a significant level of confidence. The ability to impact business performance by increasing sales did not receive the same level of agreement, ranking last with a mean score of 2.55 (table 19). The overall ranking of financial considerations related to cloud computing—combining reducing cost and increasing sales—shared second place with innovation among the six current strategy-related expectations. The mean score for confidence in finance is 3.05, indicating a moderate level of confidence that financial expectations are being met by cloud computing.

Table 19—Financial Components in the Confidence Barometer

Financial Component	Mean Score
Reduce cost	3.26
Increase sales	2.55
Overall	3.05

Alignment

The fourth strategy-oriented element of cloud confidence addresses cloud’s ability to create greater alignment between IT and the business, support the business strategy, and assist in integrating IT and business strategies. Together these measures have a mean score of 3.01, positioning it at fourth place among the six confidence measures.

Optimizing the use of IT to support business units, which is the lowest stage of alignment, ranked third in the overall list of 16 general strategy confidence measures (mean score 3.23). This demonstrates a moderately strong level of confidence that cloud, as it is currently used, is bringing IT and business units together. The next degree of alignment—using cloud to better align IT with business needs—has a mean score of 2.96 and is ranked tenth in the list of 16 general strategy

confidence measures. The highest level of alignment—integrating IT and business strategies—ranked 14 among the 16 strategy confidence measures and has a mean score of 2.83 (table 20). These results taken together indicate that cloud is providing positive results at the simplest level of alignment—using IT to address business needs—but higher levels of alignment, including aligning IT with business needs and integrating strategies, require cloud to reach a higher level of market maturity not yet realized.

Table 20—Alignment Components in the Confidence Barometer	
Alignment Component	Mean Score
Optimize the use of IT to support business units	3.23
Align IT with business needs	2.96
Integrate IT and business strategies	2.83
Overall	3.16

Customer

Cloud is recognized as a means to provide interesting applications and share information in unique ways. However, enterprises that adopt cloud may also benefit by enhancing the quality of customer interactions and improving customer satisfaction with these interactions or the services they receive. Both of these elements are included in the customer perspective on meeting expectations. Of these two elements, there was a higher level of confidence that cloud is currently enhancing customer interactions (mean score 3.00). It ranked seventh in the list of 16 strategy confidence measures. The other element—enhancing external customer satisfaction—reflected slightly less confidence among participants, with a mean score of 2.85 and ranked 13 in the list of 16 strategy components (table 21). Making more interactions is apparently easier to achieve than making them better.

Table 21—Customer Components in the Confidence Barometer	
Customer Component	Mean Score
Enhance external customer interaction	3.00
Increase business customer satisfaction	2.91
Enhance external customer satisfaction	2.85
Overall	2.92

Opportunity

The last of the high-level strategy-related confidence measures—opportunity development resulting from cloud—ranked last among the six measures. This item addressed the level of confidence that cloud would create revenue opportunities for cloud users and open new markets (table 22). These ranked at the bottom of the 16 detailed confidence measures, taking the last and second to last positions, respectively. As a disruptive technology, cloud can be expected to open markets or increase revenue opportunities only if there is alignment between the use of cloud and business strategy and if cloud is used to provide innovative and interesting business solutions with which to engage customers. If cloud is used in less innovative ways, as would be expected in a less mature position, opportunities to enter new markets or to provide new revenue will be limited.

Table 22—Opportunity Components in the Confidence Barometer	
Opportunity Component	Mean Score
Open new markets	2.88
Create revenue opportunities for cloud users	2.76
Overall	2.82

Problem Resolution Confidence

On a regular basis, reports in the press attest to the benefits of cloud as well as cautionary stories about its problems and challenges. Unfortunately, the problem stories may be outnumbering the positive reports, thus increasing the general level of fear about cloud and creating uncertainty in the market about the value it can present to enterprises. As the market matures over time, negative claims should be reduced and impressions about benefits increase—not only as a result of

more users, but also due to wider acceptance of what the technology is, what it provides and how it is best applied to solving business problems. With acceptance comes greater interest and comfort, releasing enterprises from a cautionary stance to one where exploration and innovation are possible and preferred.

A series of 27 problem statements was presented to the 252 survey takers, who were asked to rank each statement on a scale of 0 to 5 according to how confident they were that the problem described is currently being resolved. The overall level of confidence in problem resolution was reflected in a mean score of only 2.38. Of the three components that came together in the confidence barometer—service, strategy and confidence in problem resolution, all were equally low. Only strategy confidence—an expression of aspirations related to strategy, alignment, customer value and opportunity realization—received higher confidence ratings.

The 27 problem statements were grouped into eight separate categories for presentation to survey participants. Each category combined two or more related measures providing greater insight into specific problems often associated with cloud computing. Of the eight categories, not a single grouping of cloud-related problems received a score that would indicate strong confidence that problems are being resolved. None received a score indicating even a moderate level of confidence that problems are being solved. For the eight categories the scores ranged from 2.89 for cloud continuity and availability—the highest rating—to the lowest mean score of 2.06 for regulatory and legislative problems (table 23).

Table 23—Problem Resolution Components in the Confidence Barometer		
Problem Resolution Component	Mean Score	Rank
Continuity/availability	2.89	1
Performance	2.53	2
Problem management	2.42	3
User-supplier relationship	2.35	4
Solution integration	2.31	5
Security/assurance	2.25	6
Contracts	2.07	7
Regulation and legislation	2.06	8
Overall	2.37	

Continuity and Availability of Service

The most “confident” responses in the problem resolution section of the survey related to the continuity and availability of services. When considering the potential for system outages, issues related to availability, and the restoration of services in terms of disaster recovery and business continuity, survey participants expressed the most confidence that issues related to availability are being addressed (mean score 3.06). While this score is only slightly higher than the midpoint of confidence, availability is at least a positive measure that cloud issues are being addressed (table 24). Participants are only moderately confident that disaster recovery and business continuity concerns are being addressed (mean score 2.84) and even less so that system outage problems are being resolved (mean score 2.77).

Table 24—Continuity and Availability Components in the Confidence Barometer	
Continuity and Availability Component	Mean Score
Availability	3.06
Disaster recovery/business continuity	2.84
System outages	2.77
Overall	2.89

Performance

A core requirement of cloud computing is performance. When entering into a cloud agreement, users expect that a certain high level of performance (in addition to recoverability and availability) will be consistently delivered by the supplier. Within the eight categories of cloud concerns, measures of confidence that performance issues are being addressed ranked third with a mean score of 2.53—a moderate level of confidence. Several important aspects of performance are addressed in the study and each is rated within the top half of the list of 27 problem statements, attesting to both the importance of performance and the market’s concerns about it. The lack of performance standards and meaningful metrics, the ability to effectively monitor performance, the availability of experts within supplier organizations to support users, and assurance that suppliers are doing the right things to meet expected performance levels are all concerns that survey takers feel are not being effectively met at this time (table 25).

Table 25—Performance Components in the Confidence Barometer	
Performance Component	Mean Score
Service performance	2.84
Performance standards	2.58
Monitoring performance	2.55
Performance metrics	2.41
Performance assurance	2.40
Availability of expert support from suppliers	2.37
Overall	2.53

While performance is a concern for both users and providers, these groups expressed different opinions about how well problems are being addressed (table 26). The ranking is based on position within the full list of 27 problem statements.

Table 26—User and Provider Perspectives on Performance Components			
Performance Component	Overall Rank	User Rank	Provider Rank
Service performance	3	4	2
Performance standards	5	8	5
Monitoring performance	7	10	6
Performance metrics	11	16	9
Performance assurance	13	14	12
Availability of expert support from suppliers	14	13	13

The mean score for the overall response for users and providers is not very different, demonstrating that while there is a difference of opinion about the importance of particular problems there is general consensus that these are indeed problems and they are not being satisfactorily addressed at the current time. For example, the overall mean score for performance monitoring is 2.55. The score for users is 2.47 and the score for providers is 2.58. All three scores indicate what can most charitably be described as a moderate level of confidence that monitoring performance issues are being properly addressed.

Problem Management

In addition to resilience and performance, cloud providers need to develop problem management capabilities that not only address their internal management needs but also support the areas where users and providers come together in services. Problem management ranks second among the eight general problem categories in terms of confidence that problems are being addressed (mean score 2.42). This category includes the ability to detect problems and to escalate them when necessary (table 27).

Table 27—Problem Management Components in the Confidence Barometer

Problem Management Component	Mean Score
Problem resolution	2.57
Problem escalation	2.53
Legal issues	2.15
Overall	2.42

As might be expected, users and providers express different perspectives about problem management related to cloud computing. To the benefit of providers, users ranked problem resolution as sixth among the 27 problem statements (mean score 2.69) in terms of cloud problems being addressed while providers rated it eighth (mean score 2.52). Both users and providers feel that problem escalation is still a problem. Users ranked it fifth and providers ranked it tenth out of the 27 problem statement (**table 28**). Obviously providers are more confident that problems can be effectively escalated. For both users and providers, legal issues are a concern that currently is not adequately addressed for either party.

Table 28—User and Provider Perspectives on Problem Management Components

Problem Management Component	Overall Rank	User Rank	Provider Rank
Problem resolution	6	6	8
Problem escalation	9	5	10
Legal issues	24	20	24

User-Supplier Relationship

The cloud user-supplier relationship is an essential element of cloud market maturity. As users become more satisfied with what the market provides in terms of reliable and safe services and products, they will be more inclined to adopt these services and products. Market maturity is associated with cloud users' confidence in the offerings and the suppliers.

Cloud user-supplier relationships (which included the credibility of suppliers, the longevity of suppliers, and the glue binding suppliers and users together—the service level agreement) ranked fourth among the eight problem resolution confidence measures. (It is surprising that among these three, there is the highest level of confidence that service level issues are being addressed [**table 29**], whereas the performance monitoring component, which covered monitoring and performing against service level agreements, rated last among the six elements of service confidence [refer to **table 8**].) Credibility and longevity of suppliers ranked 19 and 21, respectively, among the 27 problem resolution statements.

Table 29—User/Supplier Relationship Components in the Confidence Barometer

User/Supplier Relationship Component	Mean Score
Service level agreements	2.55
Ability to manage vendors	2.33
Credibility of suppliers	2.30
Longevity of suppliers	2.20
Overall	2.35

Users and suppliers differ in expressing confidence that provider credibility is being addressed. Suppliers rated it 15 on the list of 27 problem statements being addressed (mean score 2.33) while users rated it 21. Confidence that the potential problem of supplier longevity is being addressed ranked 24 for users and 21 for providers. Service level agreements (SLAs) provide the point where user expectations and provider performance come together. In general, survey participants are more confident that service level problems are being addressed, ranking it eighth among the 27 potential problems. Its mean score is 2.57 indicating a moderate level of confidence that the problem is being addressed. Providers have a greater level of confidence that service level problems are being addressed, ranking it seven, as compared to users' ranking of nine (**table 30**).

Table 30—User and Provider Perspectives on User-Supplier Relationship Components

User/Supplier Relationship Component	Overall Rank	User Rank	Provider Rank
Service level agreements	8	9	7
Ability to manage vendors	14	14	13
Credibility of suppliers	16	19	13
Longevity of suppliers	18	22	17

Solution Integration

Success in cloud computing starts with the most basic elements, including making cloud a part of the procurement process and integrating cloud services with internal systems. Making cloud a part of the standard procurement process helps to ensure that all stakeholders are engaged and that established procedures are followed. Articles have mentioned that because of the potentially low cost and periodic billing for SaaS and other cloud services, managers can purchase cloud services using a company credit card. Such purchases might bypass the standing procurement process. This can also remove cloud activities from general awareness and oversight that is a necessary part of enterprise governance.

System integration promotes solution effectiveness and efficiency. Implementing cloud without fully integrating it not only into systems so data can be shared, but into IT operations and oversight may leave enterprises at risk. Stand-alone solutions often do not provide the accumulative benefit that comes when individual parts come together in a collaborative solution. This increases the risk that the full value of the solution may not be obtained. Solutions that are not integrated into IT operations, business unit processes, or the overall governance structure for IT may provide multiple opportunities of lost benefits and increased opportunities for greater cost and potential exposure to security and resilience failures. There appears to be little confidence among those participating in this study that cloud is effectively integrated into the established procurement process or that systems and cloud solutions are being effectively integrated (table 31).

Table 31—Solution Integration Components in the Confidence Barometer

Solution Integration Component	Mean Score
Making cloud a part of the procurement process	2.35
Integration with internal systems	2.28
Overall	2.31

Security and Assurance

The security of provider services, the ability to protect information and assurance that protection expectations are being met often top the issues included in cloud computing discussions. Security and assurance placed six out of the eight summary confidence measures for problem resolution, with a mean score of 2.25, indicating a mild level of confidence that related concerns are being addressed. The security and assurance topic includes concerns related to multitenancy, general information security, testing and assurance, data ownership and custodian responsibilities, and privacy. Of these, confidence is highest that multitenancy problems are being addressed and lowest that international data privacy issues are being resolved (table 32).

Table 32—Security and Assurance Components in the Confidence Barometer

Security and Assurance Component	Mean Score
Concerns for multitenancy	2.42
Information security	2.41
Testing and assurance	2.31
Data ownership/custodian responsibilities	2.18
International data privacy	1.90
Overall	2.25

Users and providers viewed security and assurance problems similarly. The only area of significant difference is for information security itself. Users are more confident than providers that security issues are being addressed, the overall rating is 12 among the 27 problem statements (mean score 2.61) as compared to providers' ranking of 17 (mean score 2.31). It is not a large difference, but it is interesting to note that users have a higher level of confidence in information security than do providers (table 33).

Security and Assurance Component	Overall Rank	User Rank	Provider Rank
Concerns for multitenancy	10	12	11
Information security	12	7	17
Testing and assurance	18	18	18
Data ownership/custodian responsibilities	22	22	23
International data privacy	25	25	26

Within user organizations, differences are seen among workers in business units, information security and information technology departments (table 34). In every one of the security and assurance items, except for testing and assurance, security personnel are less confident that issues are currently being addressed. The difference in ranking among business, information security and IT participants is especially striking for the concerns for multitenancy item. The information security personnel who participated in the study displayed considerably less confidence than business and IT professionals that those problems are being solved.

The rankings of the three disciplines vary across the security and assurance components, perhaps as a factor of the closeness each practitioner has to the issue at hand. Security is much closer to and directly involved in testing and assurance for cloud. Having a stake in this, those professionals may see that more progress is being made in addressing this concern. In a similar manner, IT personnel understand and are directly involved with multitenancy within the enterprise and from cloud providers. This knowledge and experience may influence their perception of how related solutions are being progressed. Business professionals, on the other hand, may have been influenced by comments about multitenancy from various sources without having the benefit of being directly involved in the technology. And, for security, there may be security-specific issues related to multitenancy that security deals with that are not a pure technology or business issue.

Security and Assurance Component	Overall Rank	Business Rank	Security Rank	Technology Rank
Concerns for multitenancy	10	13	15	8
Information security	12	11	14	13
Testing and assurance	18	22	10	21
Data ownership/custodian responsibilities	22	23	23	19
International data privacy	25	25	27	25

Contracts

Contracting for cloud services is a fundamental part of cloud acceptance and market maturity. Within the eight categories of security and assurance concerns, contracting is near the bottom of the confidence rankings (ranked seven). Contracting is an essential part of cloud market growth and in enabling cloud to become a central component of innovation. The two specific issues included in the cloud contracting category are contract lock-in and exit strategies. Contract lock-in is rated 23 on the list of 27 individual problem statements with a mean score of 2.18, indicating a less-than-robust level of confidence that concerns for contract lock-in are being addressed (table 35). Exit strategies rank even lower (26) in the list rating confidence that security and assurance problems are being addressed.

Table 35—Contract Components in the Confidence Barometer

Contract Component	Mean Score
Contract lock-in	2.18
Exit strategies	1.88
Overall	2.03

Users feel much stronger than providers that exit strategies and contract lock-in are not currently being addressed. They ranked contract lock-in at 23 in confidence and exit strategies at 26. Providers also ranked these two items low, but with slightly more confidence (table 36).

Table 36—User and Provider Perspectives on Contract Components

Contract Component	Overall Rank	User Rank	Provider Rank
Contract lock-in	23	23	22
Exit strategies	26	27	25

Participants in Asia do not see contract lock-in as significant a problem in terms of being addressed as do participants in Europe or North America (table 37). Asian participants also have less confidence that exit strategies are being addressed when compared with European or North American participants.

Table 37—Geographic Perspectives on Contract Components

Contract Component	Overall Rank	Asia Rank	Europe Rank	North America Rank
Contract lock-in	23	14	20	23
Exit strategies	26	27	25	25

Regulation and Legislation

The area of least confidence deals with regulation and legislation. This combined measure, which includes regulatory compliance and government regulations keeping pace with the market, ranks last of the eight combined measures, indicating the lowest degree of confidence that related issues are currently being addressed (table 38). Enterprises must carry significant cost to meet regulatory requirements. At the same time, regulators place limits on enterprises that complicate technology innovation. These two elements combined render the ability of government to keep pace with technology essential. Because the government has such power to influence technology adoption, it is even more critical for government and regulators to understand cloud computing and adopt a regulatory stance that enables, rather than limits, the adoption of cloud.

Table 38—Regulation and Legislation Components in the Confidence Barometer

Regulation and Legislation Component	Mean Score
Regulatory compliance	2.34
Government regulations keeping pace with the market	1.80
Overall	2.06

Optimism Barometer

Cloud market maturity is not stationary. Maturity is constantly in transition—from introduction and infancy to maturity and decline. During the maturity process, new and exciting innovations are introduced. These additions become possible when cloud-related issues are addressed and resolved, giving users a higher level of comfort, which leads to greater innovation and increased value from investments.

To quantify what will come, future views of several aspects of cloud have been combined to create an optimism barometer. This measure provides a consolidated look into the issues and opportunities that were addressed within the confidence barometer. While the confidence barometer measures the confidence level that issues are currently being addressed, the optimism barometer indicates the level of confidence with which these issues will be addressed. This future view into strategy confidence and problem resolution confidence suggests the expected change that will lead to the maturity of cloud products and services.

The mean score for the optimism barometer encompassing strategy confidence and problem resolution confidence is 3.47, indicating what can be described as cautious optimism that cloud will advance in maturity, and, as it advances, problems that are seen limiting adoption will be addressed and expected benefits will be realized. While there appears to be significant optimism, this optimism is balanced with caution as some fundamental aspects of cloud need to be clarified and expectations addressed.

Strategy Optimism

For the confidence barometer, users were asked to indicate their level of confidence that cloud computing is meeting current expectations specific to strategy. For the optimism barometer, these same items were presented to study participants and they were asked to indicate the extent to which they believed that these concerns and requirements would be addressed in the future. **Table 39** presents the rankings and mean scores of the six strategy elements both currently (confidence) and in the future (optimism).

Strategy Component	Current		Future	
	Rank	Mean Score	Rank	Mean Score
Enterprise strategy	1	3.16	1	3.58
Innovation	2	3.05	2	3.48
Customer	4	2.92	3	3.44
Alignment	3	3.01	4	3.45
Finance	2	3.05	5	3.43
Opportunity	5	2.82	6	3.36

The most significant changes in cloud expectations are predicted to be seen in customer interaction and satisfaction and in the area of finance (cost reduction and increased sales). Customer-related aspects of cloud moved from a ranking of fourth, for current (confidence), to third, for future (optimism). While the change in ranking of finance is even more significant, what is especially noteworthy is that the shift is in the negative direction. Finance, as measured by cost reduction and increased sales, moved from the second area of highest current confidence to the fifth, in terms of future confidence. This may not be a negative indication because many measures that were found at the lower levels in the confidence ranking moved to higher levels with regard to optimism, thereby bumping down higher ones, such as finance. The reduced ranking of finance demonstrates greater confidence in the integration of cloud into enterprise strategies, enhanced abilities to innovate, more significant alignment within enterprises and with suppliers, and enhanced opportunity to effectively deploy cloud. The mean scores make it clear that there is growing confidence that enterprises will receive greater value from cloud services.

In terms of customer satisfaction and interaction, those participating in the study evidence greater confidence in the future that customer interactions will be enhanced by cloud (mean score 3.47) and they will be more satisfied with cloud interactions (mean score 3.46). Both are approaching what can be considered a significant level of confidence in customer satisfaction.

Problem Resolution Optimism

Another aspect of cloud incorporated into the optimism barometer is confidence that cloud-related problems will be addressed in the future. This measure, composed of the same eight problem resolution categories as used for the confidence barometer, has a mean score of 3.36, indicating a significant level of confidence (**table 40**).

The most significant change is witnessed in concerns related to solution integration which made two positive steps in confidence. Regulation and legislation, security and assurance and performance each moved one step in ranking toward positive change.

Table 40—Problem Resolution Components in the Optimism Barometer

Problem Resolution Component	Current		Future	
	Rank	Mean Score	Rank	Mean Score
Continuity/availability	1	2.89	1	3.69
Solution performance	3	2.56	2	3.46
Solution integration	5	2.31	3	3.44
Problem management	2	2.42	4	3.41
Security/assurance	6	2.25	5	3.35
User-supplier relationship	4	2.35	6	3.32
Regulation and legislation	8	2.06	7	3.23
Contracts	7	2.07	8	3.07

Among the problem resolution elements the greatest positive change is seen in solution integration, moving from the fifth position in terms of current confidence to the third in relation to optimism. The two components of solution integration—making cloud a part of the procurement process and integrating cloud solutions with internal systems—show positive change. Integrating cloud into the procurement process moved from being ranked number 20 in terms of current confidence (mean score 2.28) to number 14 for future confidence (mean score 2.34). Integrating cloud with internal systems did not change in terms of their relative ranking. The mean score did change from the current level of 2.35 to a future confidence level of 3.43.

In the confidence barometer, the ability of government regulations to keep pace with changing technology and market conditions is ranked last among the problem resolution statements; in the optimism barometer, it still is in last place indicating concern about government regulations. While the ranking has not changed, the mean score shifted from a low level of confidence (1.80) to a stronger but still less than significant level of confidence (2.98).

Directly connected to the ability of government to keep pace with market and technology change is regulatory compliance. When the premise about technology on which regulations are created is outdated or restrictive, the resulting regulations are likely to create barriers to incorporating new technologies or ways of doing business. Confidence that regulatory compliance issues are being currently addressed is 2.34, giving it a rank of 16 among the 27 problem statements. Survey participants have more optimism than confidence, however, its mean score of 3.47 indicates their greater level of confidence that regulatory compliance issues will be addressed in the future and bumped regulatory compliance up to position 11 on the list of 27.

Survey participants expressed a general feeling that security and assurance concerns will be addressed in the future (table 41). Information security, testing and assurance, data ownership and custodian responsibilities, and international data privacy all demonstrated a higher level of future confidence that they will be resolved.

Table 41—Security and Assurance Components in the Optimism Barometer

Security and Assurance Component	Current		Future	
	Rank	Mean Score	Rank	Mean Score
Information security	12	2.41	8	3.51
Concerns for multitenancy	10	2.42	16	3.42
Testing and assurance	18	2.31	17	3.38
Data ownership/custodian responsibilities	22	2.18	18	3.31
International data privacy	25	1.90	24	3.18

Security is a current concern and will continue to be a significant concern in the future. The good news is that there is optimism that security, privacy, data ownership, and assurance issues are being and will continue to be addressed. International data privacy, data ownership and custodian responsibilities, and information security—commonly discussed cloud computing concerns—all show increased levels of future confidence. While international data privacy only moved up one position in terms of the ranking, the mean score moved 1.28 points, a significant shift in confidence.

Table 34 demonstrated that the level of current confidence in security problems being addressed varies depending on the respondent’s role in the enterprise. Those variations were reflected in future optimism as well (**table 42**).

Security and Assurance Component	Business		Security		Technology	
	Rank	Mean Score	Rank	Mean Score	Rank	Mean Score
Concerns for multitenancy	6	3.67	17	3.30	12	3.43
Information security	7	3.60	12	3.46	6	3.55
Testing and assurance	8	3.60	11	3.48	24	3.13
Data ownership/custodian responsibilities	25	3.29	18	3.32	17	3.30
International data privacy	23	3.37	24	3.14	23	3.14

The study participants display a significant degree of confidence that issues will be addressed in the future. The issues presented in **table 43** moved in a positive direction from lower-level current confidence rankings to ranks of optimism demonstrating confidence that they will be addressed in the future. This shift demonstrates an optimism that currently held concerns that may limit movement to the cloud or hinder significant investment in types of use or innovative applications will not continue to be limiting factors in the future. There seems to be a sense of optimism related to cloud that issues can be solved and progress will be made.

Component	Current		Future	
	Rank	Mean Score	Rank	Mean Score
Disaster recovery/business continuity	2	2.84	1	3.75
Service level agreements	8	2.55	3	3.58
Performance metrics	11	2.41	6	3.53
Information security	12	2.41	8	3.51
Regulatory compliance	16	2.34	11	3.47
Performance assurance	13	2.40	12	3.47
Integration with internal systems	20	2.28	14	3.45
Testing and assurance	18	2.31	17	3.38
Data ownership/custodian responsibilities	22	2.18	18	3.31
Legal issues	24	2.15	19	3.29
International data privacy	25	1.90	24	3.18

Advancing Cloud Market Maturity

Cloud computing is in its infancy. Only one of the three service models—SaaS—is approaching the growth maturity level according to the study participants, and they estimate it will take at least two years before cloud solidly enters the growth stage of maturity.

To mature, cloud computing, like any new market offering, needs to be understood. The market needs to have a solid comprehension of what benefits are provided, what risk must be understood and addressed, and what basic concerns about the offering need to be mitigated. The lack of a common understanding of cloud—especially at higher levels in the enterprises and outside of the technology organization—compounds the perception that cloud is in its infancy. As these study results demonstrate, cloud computing is treated primarily as a technical innovation rather than as a business enabler, and its associated risk is addressed from a technical rather than operational, or enterprise, perspective. Finally, as a new innovation at the earliest stage of maturity, user and provider expectations have not been fully satisfied by the products available in the market or in how products offered by providers are leveraged and integrated to provide value.

Within each maturity level, user confidence in the offering, the extent of integration between providers and users, and the level of innovation within the market change. Cloud computing's value proposition will continue to evolve as users become comfortable with the available offerings, processes are integrated between users and providers, business leaders and executives gain a better appreciation for it, and risk is addressed as an element of managing the business rather than as a technical problem. As cloud enters the growth level of maturity, the market will expand greatly—enabling greater innovation in how cloud services can be leveraged to provide true value and disrupting how information resources are used to open new market possibilities. The transition from infancy to growth will depend on several achievements: Basic concerns about cloud will need to be addressed, business leaders and executives will need to understand and integrate cloud into enterprise strategies, and operational and technical risk related to cloud will need to be understood and effectively balanced against opportunity.

As cloud matures, expectations will evolve from basic operational enhancements such as reducing cost and optimizing the ability of IT to support enterprise objectives to more value-laden expectations such as creating new revenue opportunities, opening new markets, and integrating IT and business strategies. These expectations will evolve only as concerns related to privacy, contract and legal issues, data ownership and custodian responsibilities, user/supplier relations, and integration of cloud services with internal systems are addressed. In the current market, basic considerations such as availability and recoverability, performance, and problem resolution remain a concern; however, study participants expressed confidence that these are being and will continue to be addressed.

Building confidence that core requirements are addressed and cloud can be safely leveraged requires cloud providers to build performance, protection and productivity into offerings and provide a way for users to integrate and leverage supplier processes. Users also need assurance that things are as they have been described, and when there is a deviation from expected levels of performance they will be informed and suppliers can effectively return offerings to a stable state.

CSA offers several aids to help providers and users establish a basis for coming to agreement on the controls that are offered and the extent to which trust can be established between the parties. The GRC Stack, an integrated suite, provides a basis for achieving governance, risk management and compliance goals, establishing assessment criteria, control objectives and access to supporting data. The Cloud Controls Matrix (<https://cloudsecurityalliance.org/research/ccm/>), a component of the GRC Stack, is a control framework that details specific security principles within 13 cloud-relevant domains. The Cloud Controls Matrix integrates commonly accepted security standards, regulations and control frameworks, emphasizing security control requirements and providing the structure needed to detail and clarify security concepts tailored to cloud computing.

For cloud computing to mature and for enterprises to receive the benefits promised, cloud needs to be seen less as a technology issue and more as a business enabler. This will require that executive management gain an understanding and appreciation for cloud and look to cloud as a source of innovation. Risk related to cloud needs to be addressed at the enterprise and business level rather than as a technical issue.

The Consensus Assessments Initiative Questionnaire (<https://cloudsecurityalliance.org/research/cai/>) provides a set of questions that can be asked of providers to document what security controls exist in service offerings. These control assertions provide a level of visibility into the controls required by a user and implemented by a provider. The Consensus Assessments Initiative Questionnaire also provides an opportunity for providers to publish assertions about their control structure. The CSA Security Trust & Assurance Registry (<https://cloudsecurityalliance.org/star/>) is a public registry that documents security controls implemented in cloud offerings by provider organizations using the Consensus Assessments Initiative Questionnaire or the Cloud Controls Matrix. These self-assessment reports document important cloud controls, increasing transparency within the cloud market and providing users an opportunity to accelerate their due diligence in vendor selection.

To identify and support effective risk management, CSA provides *Security Guidance for Critical Areas of Focus in Cloud Computing* (<https://cloudsecurityalliance.org/research/security-guidance/>), which informs on making educated risk management decisions regarding cloud adoption and use. The guidance is an executive-level primer for enterprises seeking a secure, stable transition to hosting their business operations in the cloud. In addition, *Top Threats to Cloud Computing* (<https://cloudsecurityalliance.org/topthreats/>) documents expert consensus on the probable threats that should concern users and providers.

ISACA provides aids that can help enterprises identify control requirements and assess compliance to these requirements. *Cloud Computing: Business Benefits with Security, Governance and Assurance Perspectives* (www.isaca.org/cloud) examines issues related to cloud computing, explaining why they are important and providing guidance on how to use cloud computing to create value. It identifies the controls and countermeasures that are required for cloud environments and provides an assurance guide based on COBIT 4.1 that can be used to audit cloud implementations. Understanding the need to integrate user/provider processes, ISACA has developed the *COBIT Process Assessment Model (PAM): Using COBIT 4.1* (www.isaca.org/COBIT-Assessment-Programme) to assist enterprises in assessing the capability of processes to achieve required outcomes. PAM, based on ISO/IEC 15504-2, provides a means for performing a process assessment useful in capability determination and process improvement, both important aspects of benefiting from adopting cloud services. PAM includes a special scoping document for performing a cloud processes assessment.

Moving cloud from a technical innovation to a business enabler requires the attention of business unit and executive management. Cloud must become an agenda item within the governance and management structure of enterprises that wish to extract its value. ISACA's COBIT 5, a globally accepted business/IT framework (www.isaca.org/cobit), provides a basis for viewing cloud computing within the end-to-end enterprise context of the governance of enterprise IT. The principles, practices, analytical tools and models contained in COBIT 5 outline the governance and management structure required to support cloud use aligned with organizational goals and stakeholder needs. COBIT 5 brings together business enablers such as principles and policies, processes, organization structures, culture, infrastructures, and people within a program that can integrate provider/user approaches into a consistent value-delivering solution.

Another publication in the ISACA Cloud Computing Vision Series, *Security Considerations for Cloud Computing* (www.isaca.org/cloud-security) presents practical guidance to facilitate the decision process for IT and business professionals concerning the decision to move to the cloud. It helps enable effective analysis and measurement of risk through use of decision trees and checklists outlining the security factors to be considered when evaluating the cloud as a potential solution. It describes the three types of service models and four major deployment models to be taken into account relative to cloud computing. This guide is meant for all current and potential cloud users who need to ensure protection of information assets moving to the cloud.

ISACA also provides material that can support understanding ROI in cloud environments. *Calculating Cloud ROI: From the Customer Perspective* (www.isaca.org/cloud) describes an approach to ROI that brings together an understanding of requirements, organization maturity, control considerations, and regulatory requirements to quantify benefits and costs associated with cloud computing. *Calculating Cloud ROI* presents an enterprisewide perspective and approach necessary for bringing cloud to the higher level of enterprise decision making and involvement that is necessary for cloud to rise to the next level of maturity and for enterprises to benefit significantly from cloud initiatives.

ISACA has also issued *Guiding Principles for Cloud Computing Adoption and Use* (www.isaca.org/cloud), directed at business and executive management. This publication identifies pressure points on enterprises when the structure, culture, policies and practices, and enterprise architecture have not evolved to address the changes inherent in the cloud computing shift. Its six principles for cloud computing adoption and use can guide management toward more effective cloud implementation and use, reducing the impact of pressure points, mitigating potential risk, and creating a more successful cloud implementation.

The resources provided by CSA and ISACA are examples of aids available from many sources to help enterprises achieve success from cloud computing initiatives. Through these successes providers and users encourage the transition of cloud from infancy to market growth. As enterprises realize value from technical applications of cloud to address IT/business unit opportunities, they will also gain the confidence and experience to envision more innovative solutions. These have the potential to more tightly integrate cloud into enterprise strategies, creating new opportunities that are more disruptive of established ways of using information and serving customers.