

Chapter 7

Findings and Recommendations

7.1 Introduction

The present cloud computing ecosystem in India was reviewed through secondary data collection based on the review of policy documents such as National Telecom Policy, 2012, ITU-T recommendations and guidelines, National e-Governance Plan (NeGP), National Policy on Information Technology, 2012, information on Digital India and reports of Department of Electronics and Information Technology (DeiTY). The information and data has also been collected from agencies such as International Telecom Union (ITU), DeiTY, Department of Telecommunications (DOT), Cloud Standards Development Organizations (SDO) and Cloud Research Organizations.

The expectations of SME clients with respect to the Service Level Agreement were examined through a semi structured questionnaire (placed at Appendix 1). This questionnaire was administered to a sample population of SME clients through online survey and information has been gathered on cloud computing services.

7.2 Findings

The survey questionnaire has been divided into three parts - Profile of the Respondent; Enterprise Profile; and Expectations from Service level Agreement and opinion for faster adoption of Cloud. The findings of the survey are given below:

7.2.1 Profile of the Respondent

The profile of the respondent was mandatory to be provided by the respondent. Following is the profile of the respondents as per the responses received to different questions:

(i) Do you deal with IT matters?

All the respondents are dealing with IT matters in their enterprises.

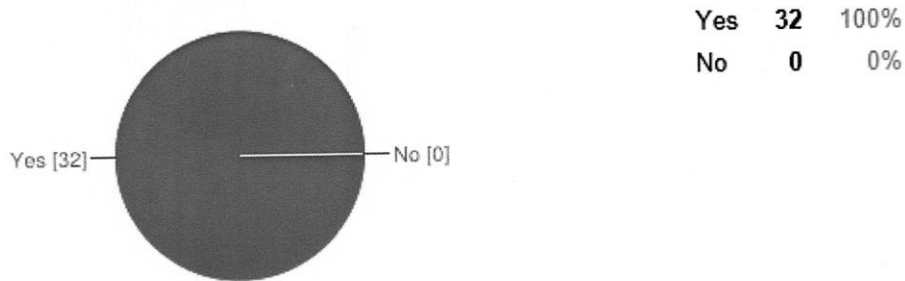


Figure 7.1: Respondent profile for dealing with IT matters

(ii) Do you deal with Service Level Agreements?

28 out of 32 (88%) respondents are dealing with Service Level Agreements in their enterprises.

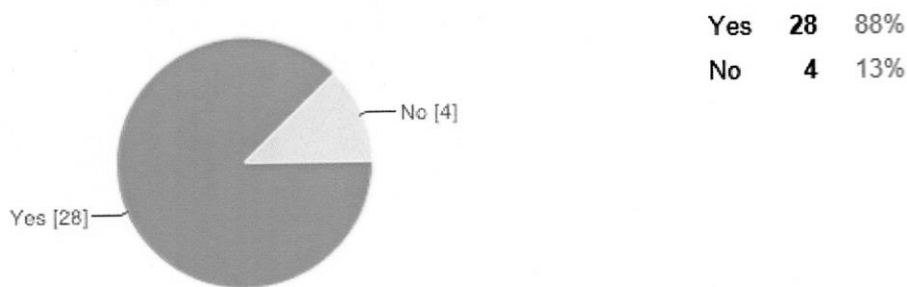


Figure 7.2: Respondent profile for dealing with Service Level Agreements

(iii) Are you aware of Cloud Services?

31 out of 32 (97%) respondents are aware of Cloud Services.

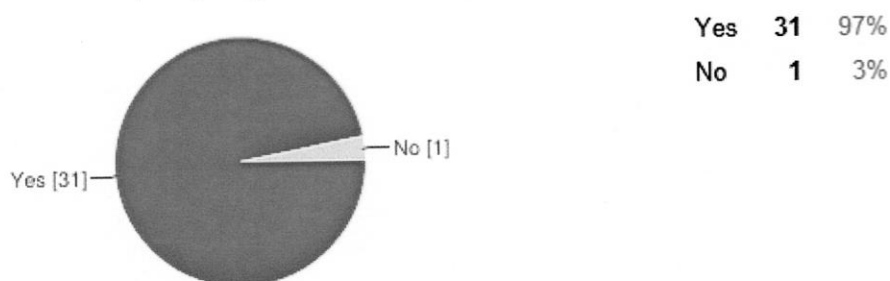


Figure 7.3: Respondent profile for awareness of Cloud Services

(iv) **Are you aware of Micro, Small and Medium Enterprises Policy?**

23 out of 32 (72%) respondents are aware of Micro, Small and Medium Enterprises Policy.

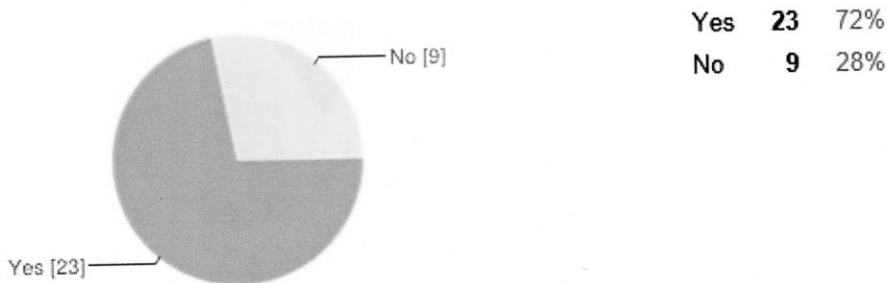


Figure 7.4: Respondent profile for awareness of MSME policy

(v) **Are you aware of "Project Badal"?**

27 out of 32 (84%) respondents are not aware of "Project Badal".

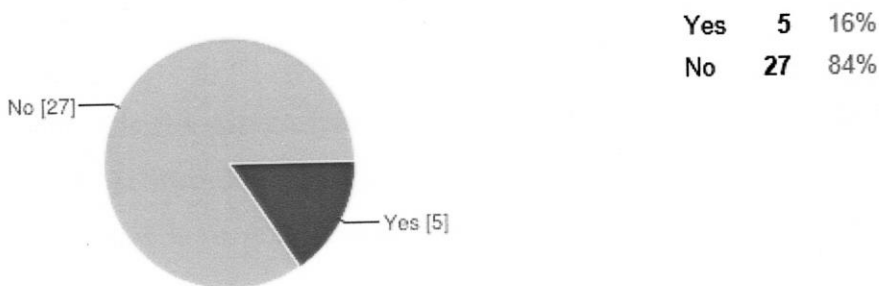


Figure 7.5: Respondent profile for awareness of Project Badal

(vi) **Are you aware of "GI Cloud - Meghraj"?**

25 out of 32 (78%) respondents are not aware of "GI Cloud - Meghraj".

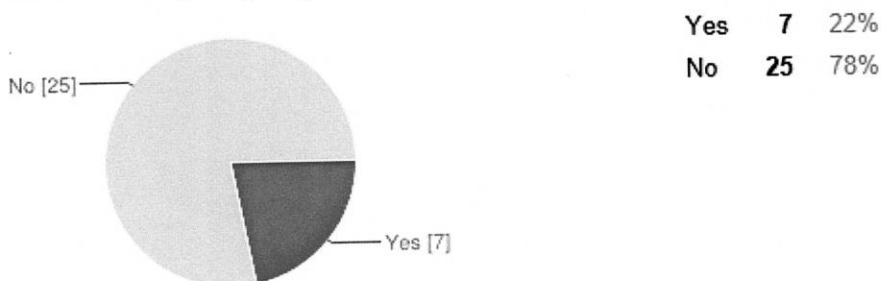


Figure 7.6: Respondent profile for awareness of GI Cloud-Meghraj

(vii) Are you aware of "Digital India"?

20 out of 32 (63%) respondents are aware of "Digital India".

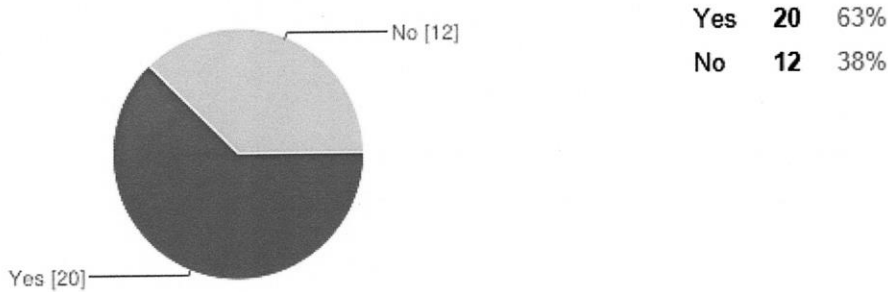


Figure 7.7: Respondent profile for awareness of Digital India

7.2.2 Enterprise Profile

The profile of the enterprise was sought through some mandatory and some optional questions. Following is the profile of the enterprises as per the responses received to some of the questions:

(i) What is the categorization of your enterprise according to Micro, Small and Medium Enterprises (MSME) policy?

13 out of 32 respondents (41%) are from Micro enterprises whereas 9 out of 32 (28%) are from Small enterprises. 4 respondents out of 32 (13%) are from Medium enterprises. However, 6 respondents (19%) did not know their categorization.

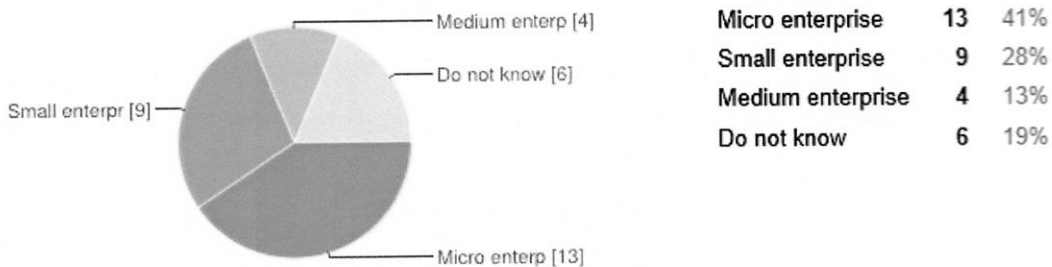


Figure 7.8: Categorization of enterprise as per MSME policy

(ii) What does best describe your business?

9 respondents out of 32 (28%) are from Manufacturing business and 21 out of 32 (66%) are in to Services business.

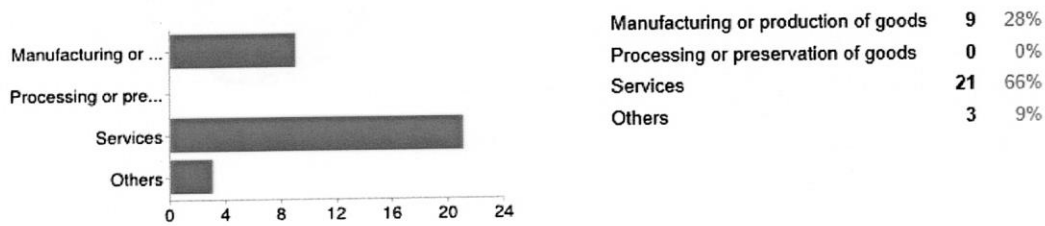


Figure 7.9: Categorization of enterprises as per business

(iii) What is the total employee strength of your enterprise?

17 out of 32 (53%) respondents are having employee strength of less than 50 whereas 3 respondents (9%) have more than 250 employees.

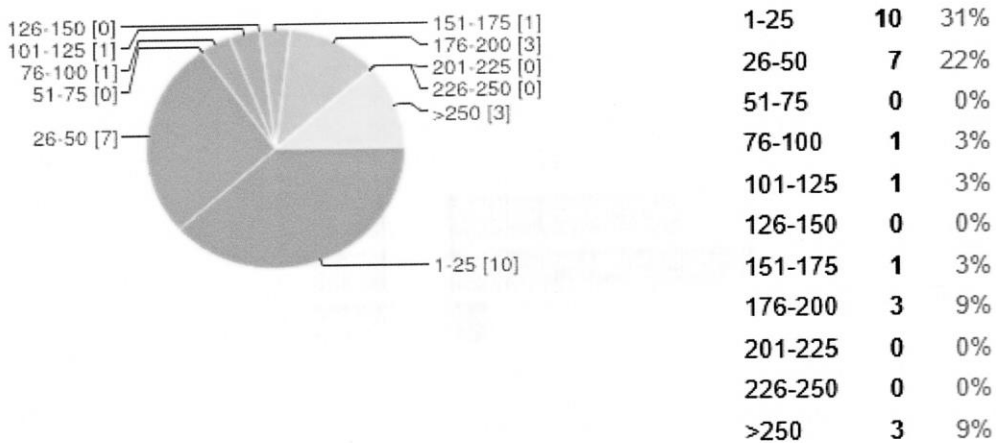


Figure 7.10: Spread of employee strength of enterprises

(iv) What type of internet connections are used in your enterprise? (Select many)

30 out of 32 (94%) enterprises are using internet through a wired connection (DSL enabled high speed phone line), whereas 25 out of 32 (78%) enterprises are using wireless internet connection (Wi-Fi, Wireless broadband) as well. 12 out of 32 (38%) are also using mobile internet (2G, 3G or 4G).

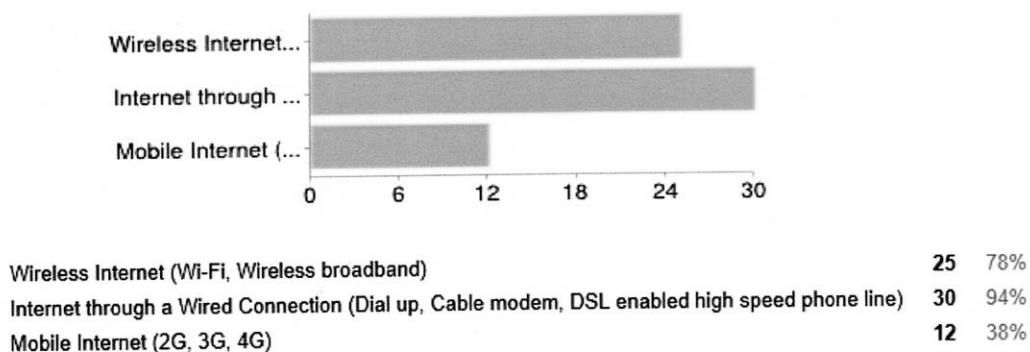


Figure 7.11: Type of internet connection used

(v) **What are the key activities done using internet? (Select many)**

Business E-mail (97%), other activities (84%), sharing information with suppliers (69%) and maintaining a website (63%) are the key activities done using internet.

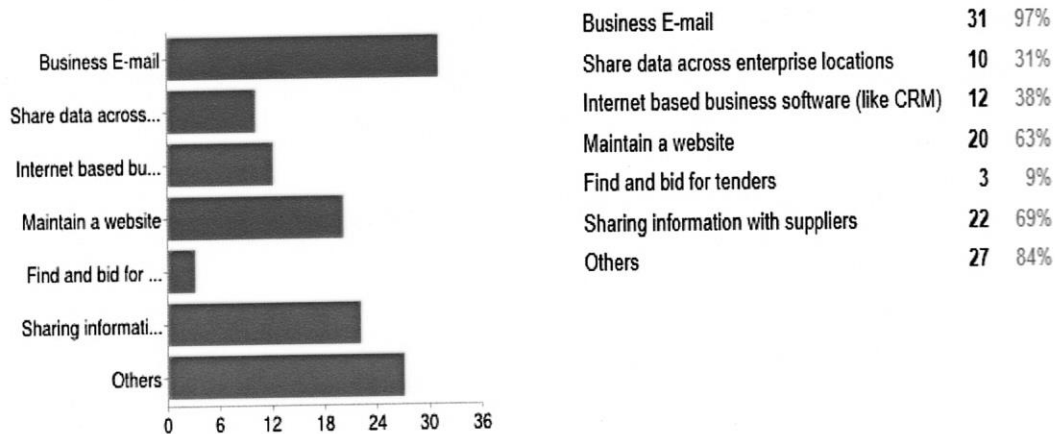


Figure 7.12: Key activities done using internet

7.2.3 Expectations from Service level Agreement and opinion for faster adoption of Cloud

The expectations of SMEs have been sought based on the Service Measurement Index (SMI) model developed by Cloud Services Measurement Initiative Consortium (CSMIC). The parameters indicating the most important hindrance for adoption of cloud and for increasing adoption of cloud were listed based on the secondary data collection and researcher's experience. A five-level rating scale has been used for getting the responses from the SMEs.

- (i) **What is the status ('Already outsourced' or 'Not outsourced' to a Cloud Service Provider) of the following activities in your enterprise and; if 'Not outsourced' then how much is the willingness of your enterprise to outsource these activities to a cloud service provider? (Rate on a scale of 1-5; where 1 represents 'not keen' and 5 represents 'most keen')?**

The inclination towards "keenness to outsourcing" for different activities has been found by adding the responses received for options 4 and 5. A large number of SMEs are keen to outsource activities such as Web presence/Web sites (78%), Customer relationships (69%), Business intranet (69%), E-mails (65%), Online collaboration (62%), Document management/ Knowledge management

(53%) and Project management (50%). However, less numbers of SMEs are inclined to outsource Procurements (47%), Virtual desktops with light weight computers (47%), Sales and order processing (31%), Human resource management (25%), Production and inventory (16%), Other activities (6%) and Financial accounting (3%). Graphical representations of the responses received for these activities are given below:

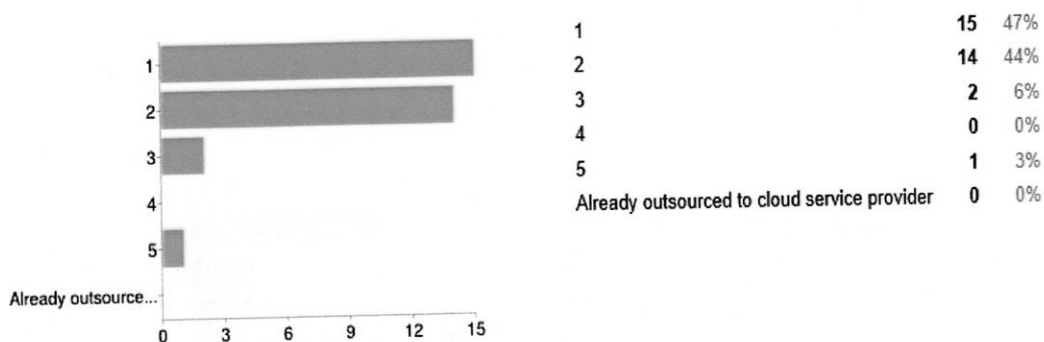


Figure 7.13: Financial accounting

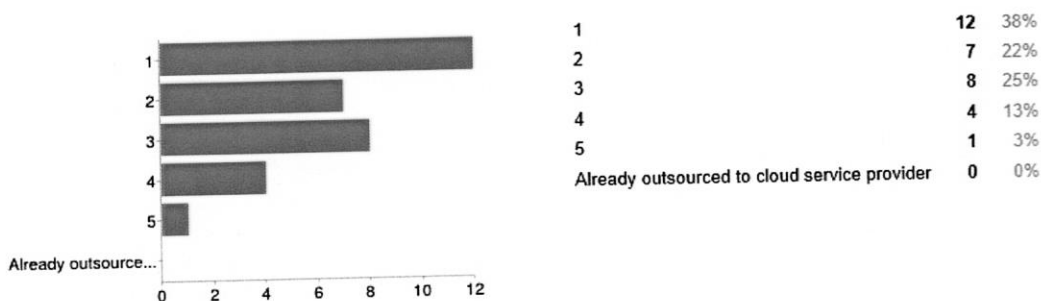


Figure 7.14: Production and inventory

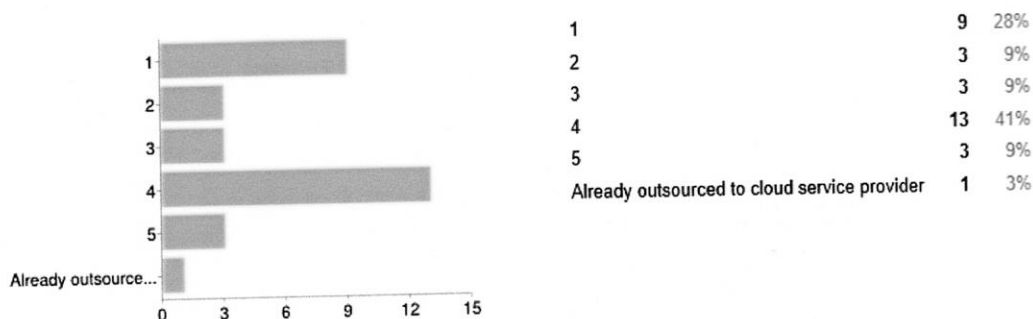


Figure 7.15: Project management

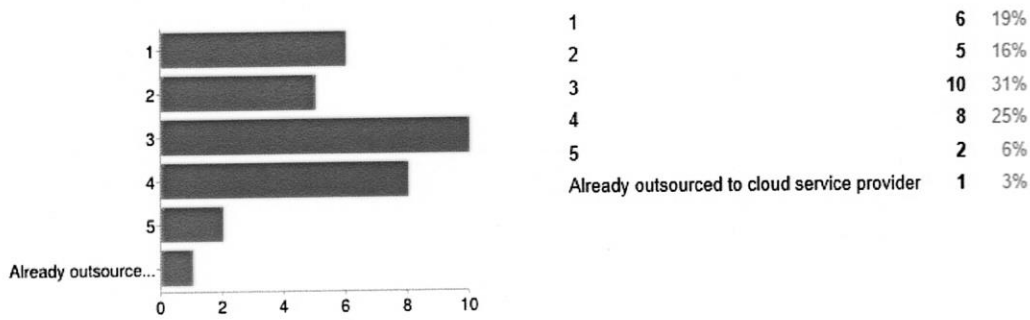


Figure 7.16: Sales and order processing

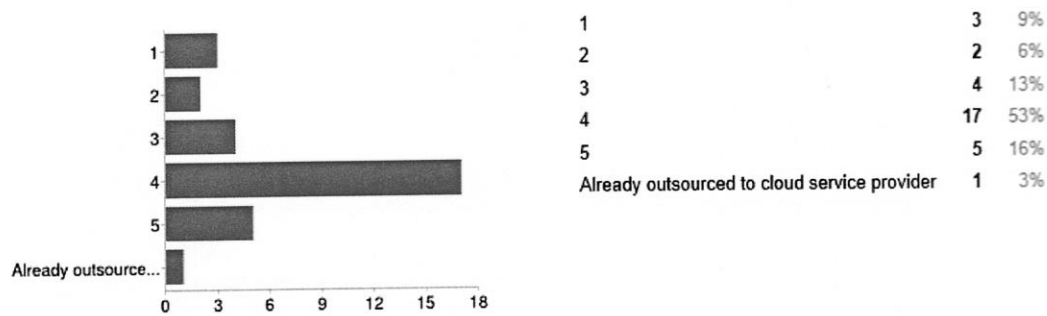


Figure 7.17: Customer relationships

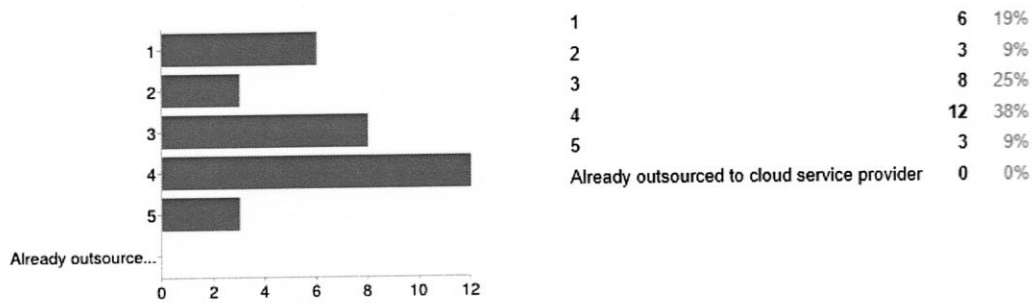


Figure 7.18: Procurements

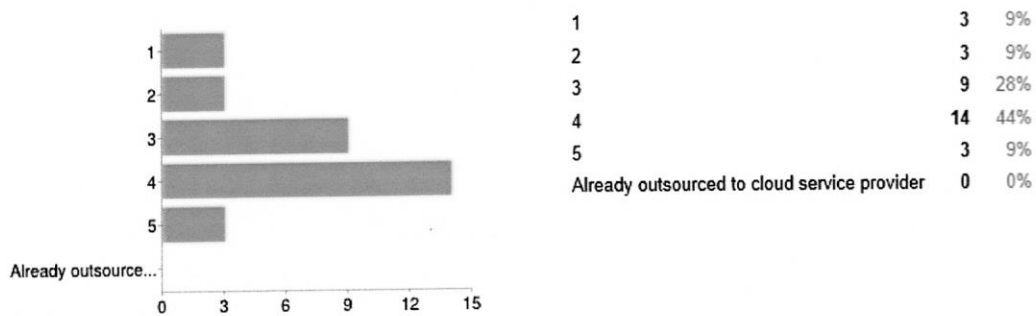


Figure 7.19: Document management/ Knowledge management

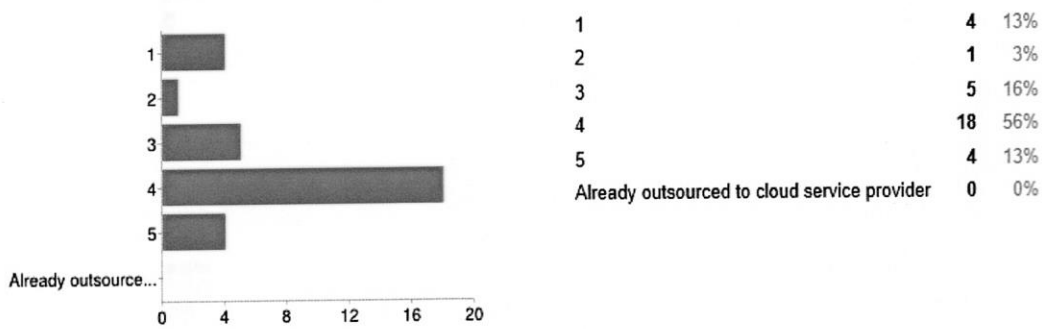


Figure 7.20: Business intranet

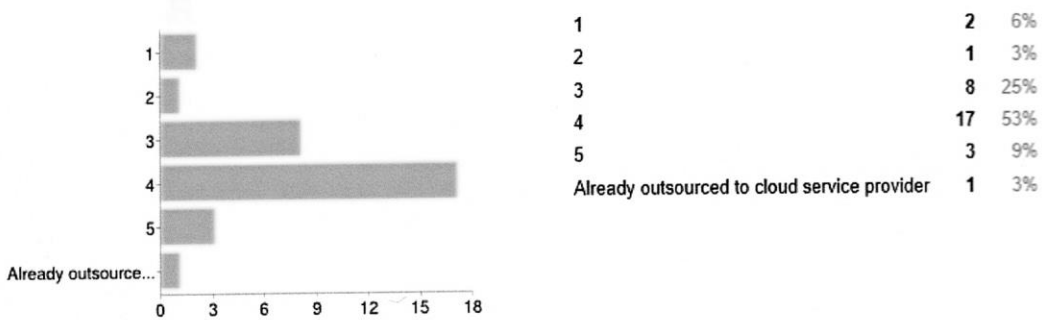


Figure 7.21: Online collaboration

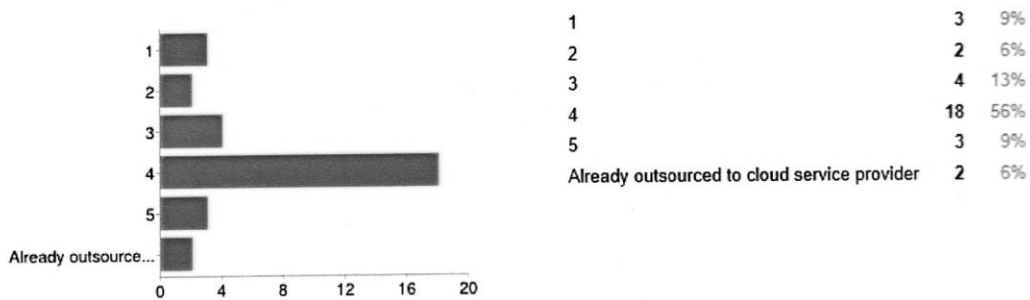


Figure 7.22: E-mails

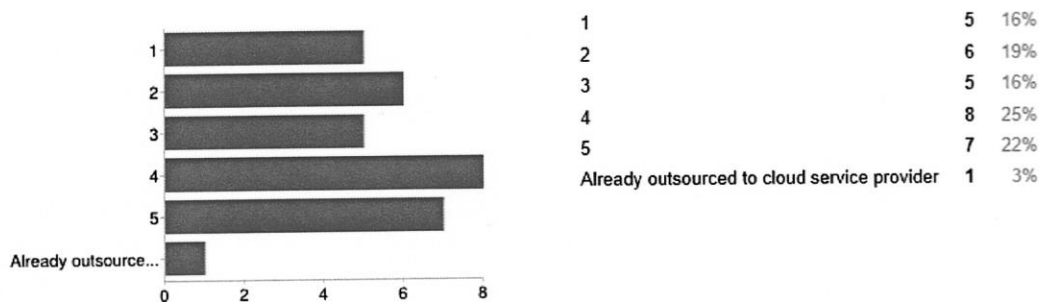


Figure 7.23: Virtual desktops with light weight computers

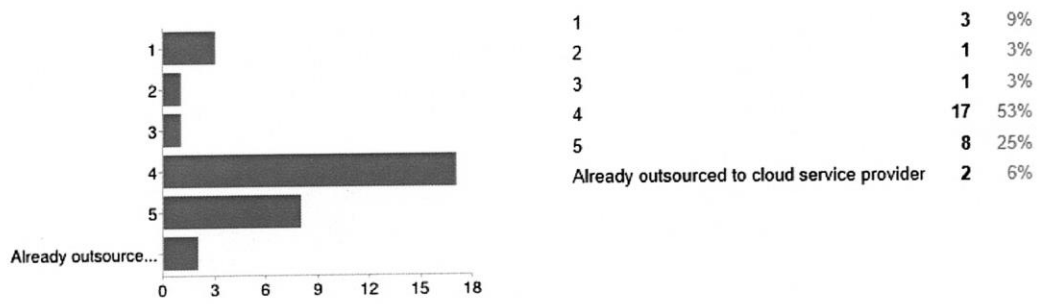


Figure 7.24: Web presence / Web sites

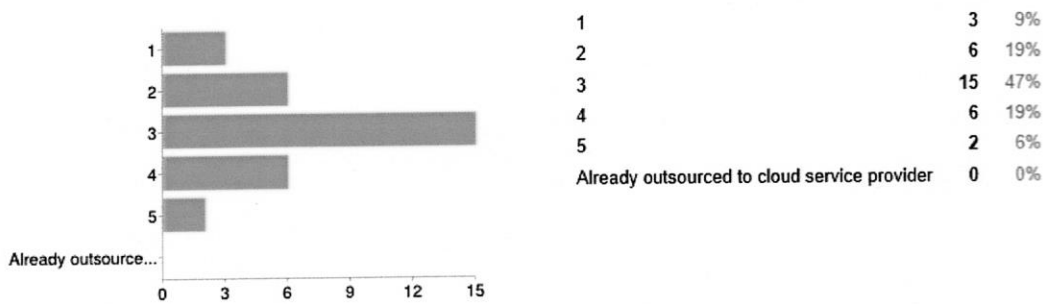


Figure 7.25: Human resource management

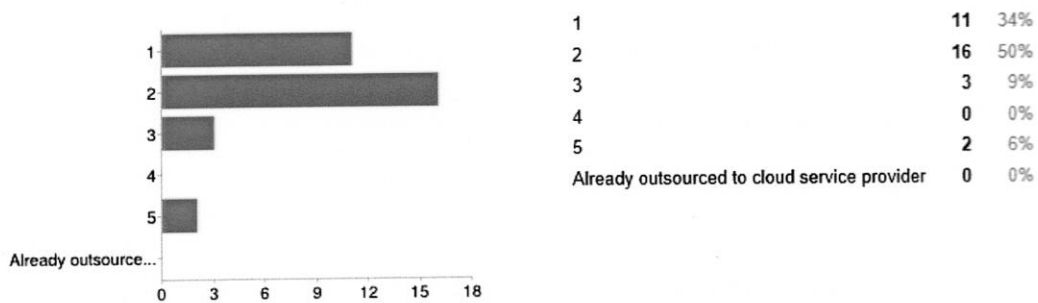


Figure 7.26: Other activities

(ii) Are you aware of the terms and conditions of the Service Level Agreement with your cloud service provider?

29 out of 32 (90%) respondents are either not using Cloud computing or cannot say about being aware of the terms and conditions of the Service Level Agreement with the Cloud Service provider.

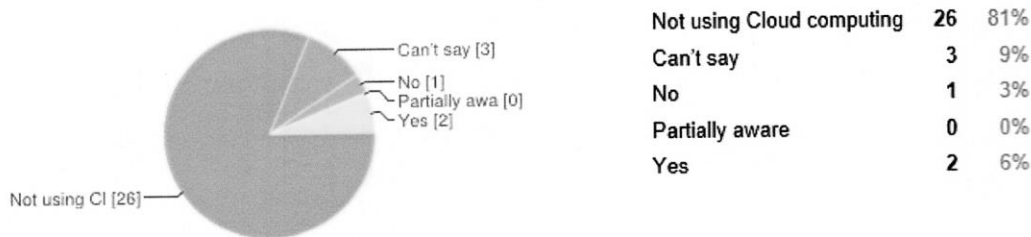


Figure 7.27: Awareness of terms and conditions of Service Level Agreement with cloud service provider

(iii) Are you satisfied with the terms and conditions of the Service Level Agreement with your cloud service provider?

29 out of 32 (91%) respondents are either not using Cloud computing or cannot say about being satisfied with the terms and conditions of the Service Level Agreement with the Cloud Service provider.

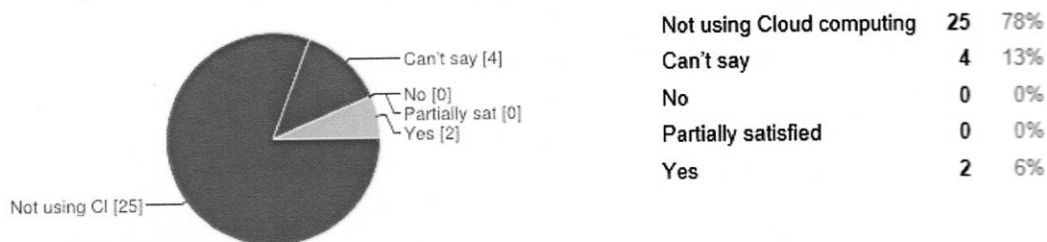


Figure 7.28: Satisfaction with the terms and conditions of Service Level Agreement with cloud service provider

(iv) The expectations from Cloud services are categorized into seven sub-headings and the relevant attributes of these sub-headings are given below to seek your opinion on each of these on a rating scale of 1-5. (Here, 1-Not important, 2-least important, 3-moderately important, 4-important, 5-most important).

The importance of different parameters or attributes has been found by adding the responses received for option 4 (important) and 5 (most important).

(1) Which of the following parameters is most important for Accountability of cloud service provider? (Rate on a scale of 1-5, 5 being most important)

Accountability contains attributes used to measure the properties related to the cloud service provider organization. The most important parameters are indicated as Ease of doing business (100%), Governance of SLA (88%),

Compliance of SLA (81%), Contracting experience (81%), Provider support (69%), Auditability of services (53%), Sustainability (50%) and Ownership of data and intellectual property rights (50%). However, less importance has been observed for Provider business stability (47%), Provider personnel skill set (47%), Provider ethicality (44%), Provider contract/SLA verification (40%), Provider certifications (29%), Provider supply chain (25%) and Other parameters (12%). Graphical representations of the responses for these parameters are given below:

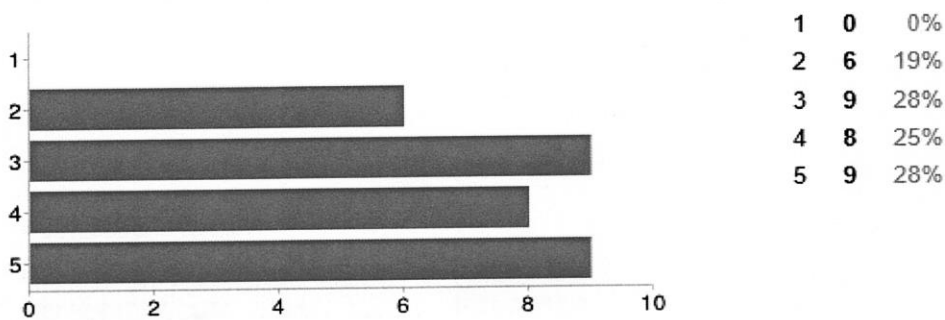


Figure 7.29: Auditability of services

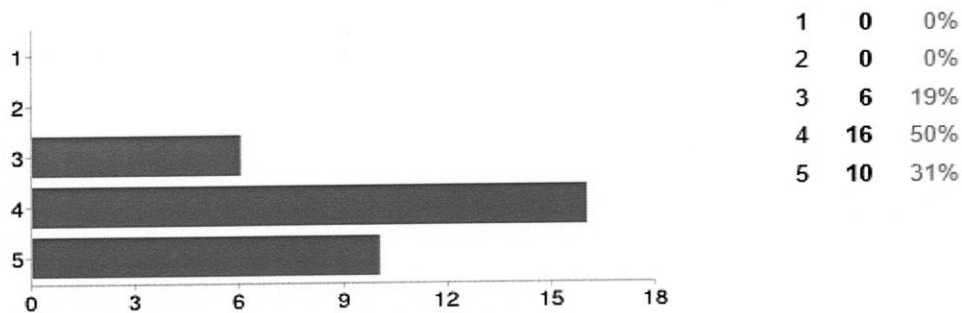


Figure 7.30: Compliance of SLA

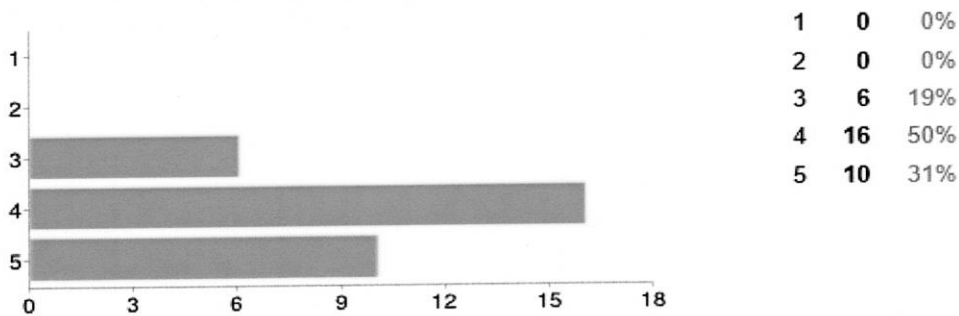


Figure 7.31: Contracting experience

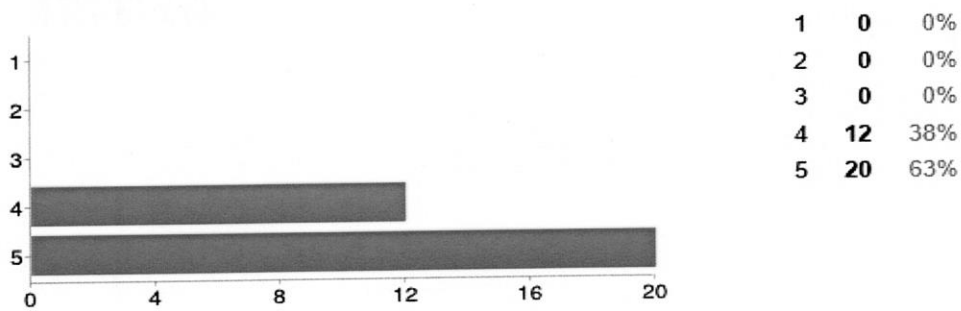


Figure 7.32: Ease of doing business

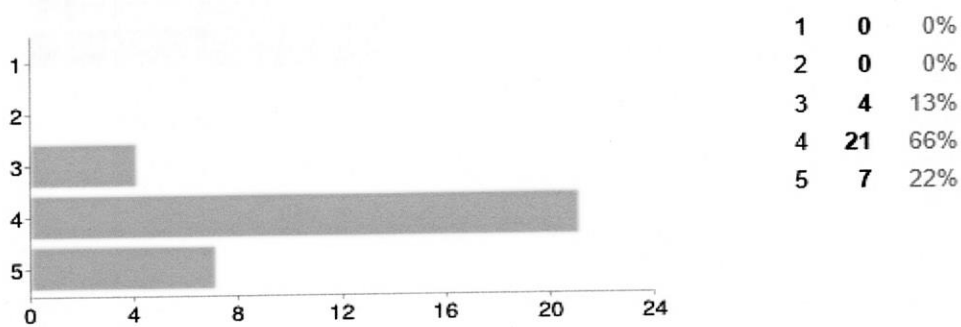


Figure 7.33: Governance of SLA

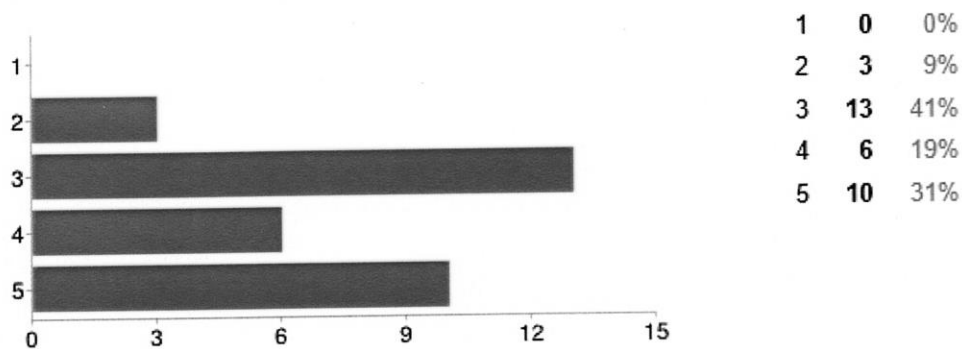


Figure 7.34: Ownership of data and intellectual property rights

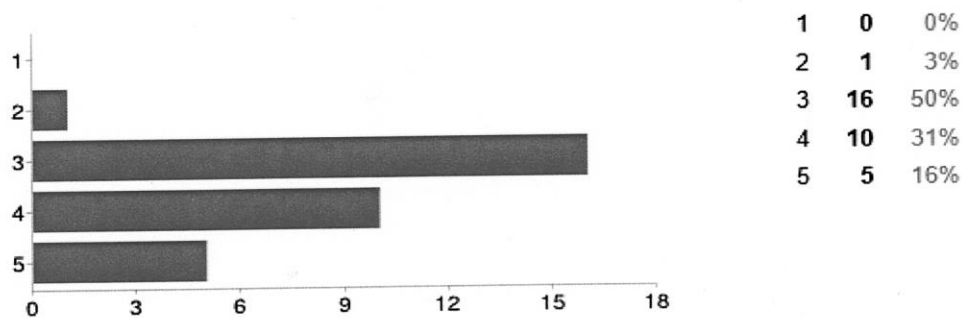


Figure 7.35: Provider business stability

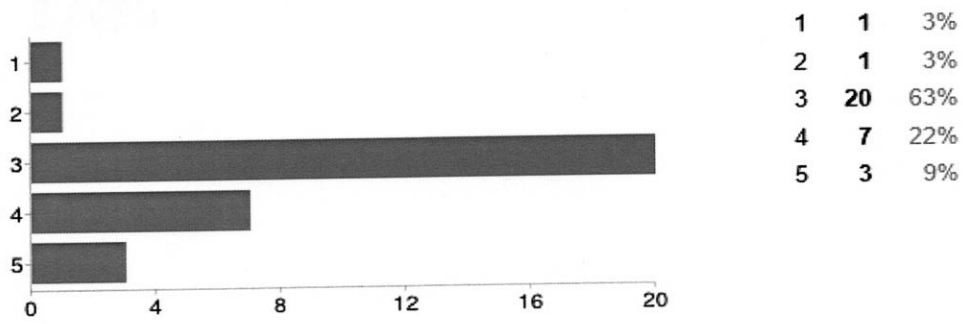


Figure 7.36: Provider certifications

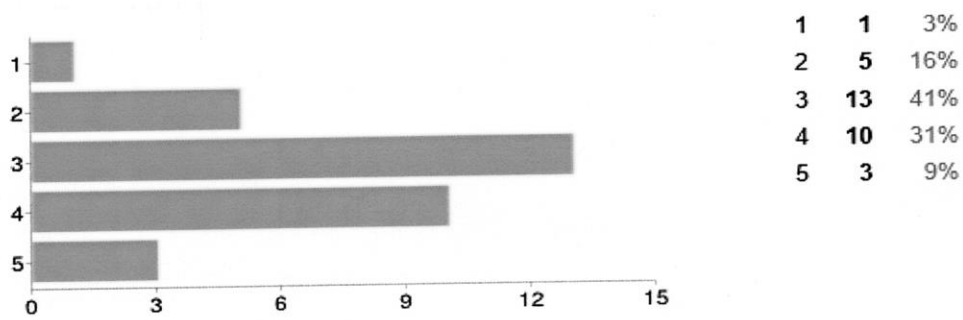


Figure 7.37: Provider contract/SLA verification

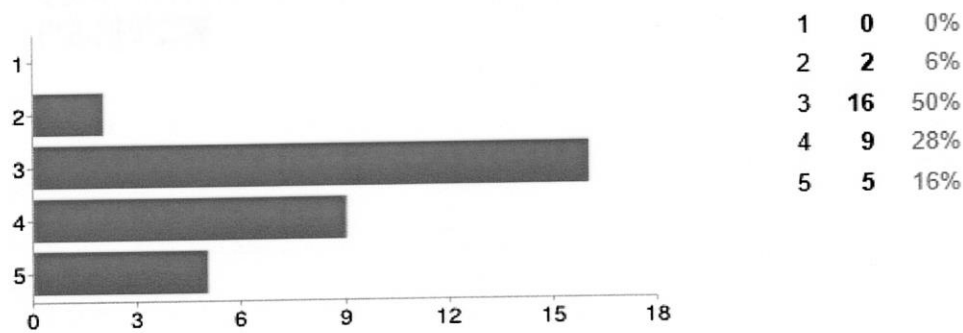


Figure 7.38: Provider ethicality

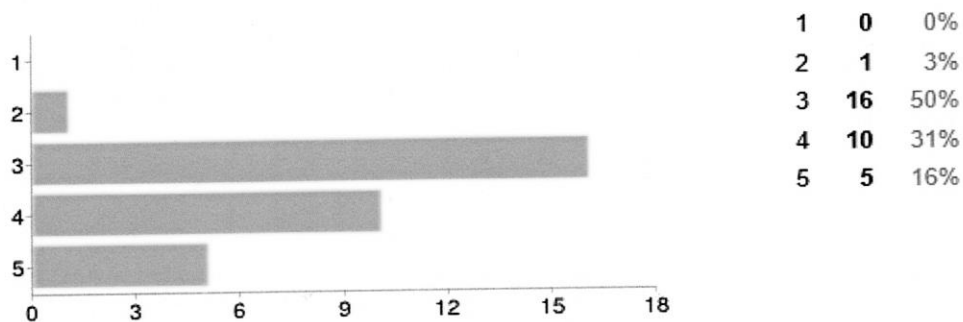


Figure 7.39: Provider personnel skill set

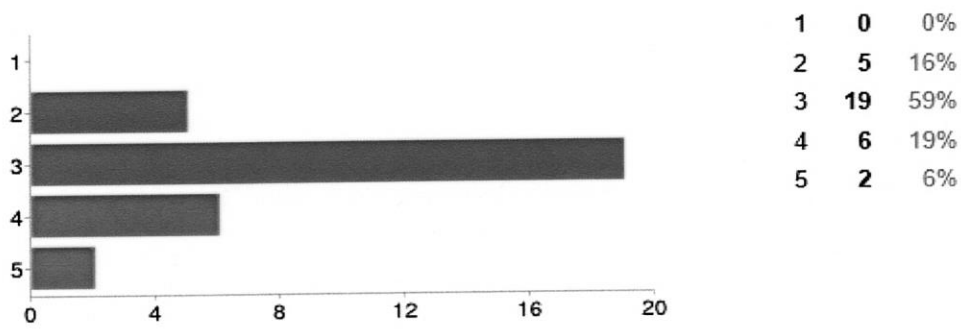


Figure 7.40: Provider supply chain

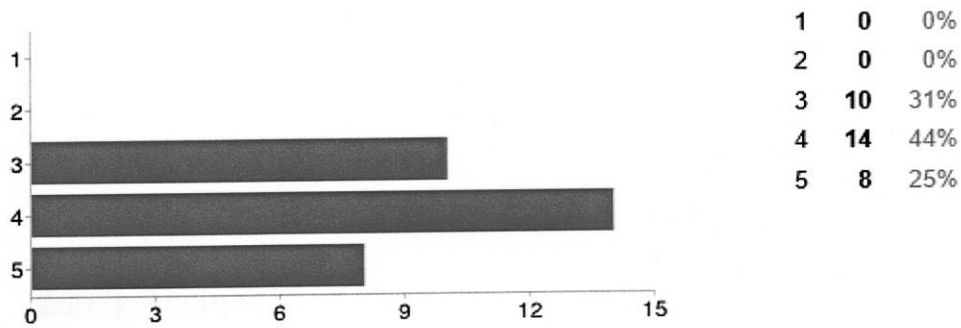


Figure 7.41: Provider support

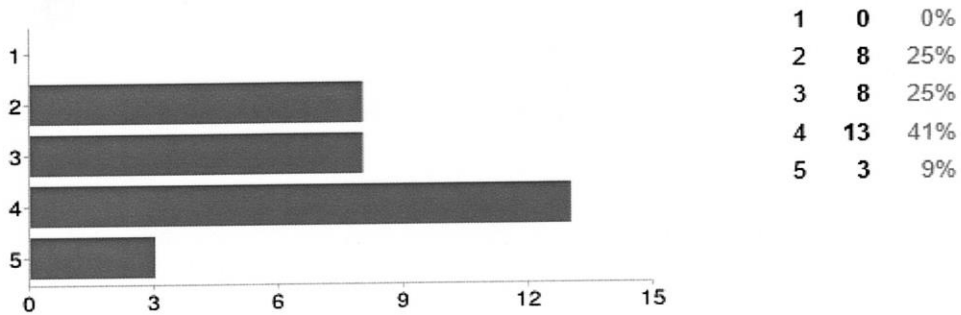


Figure 7.42: Sustainability

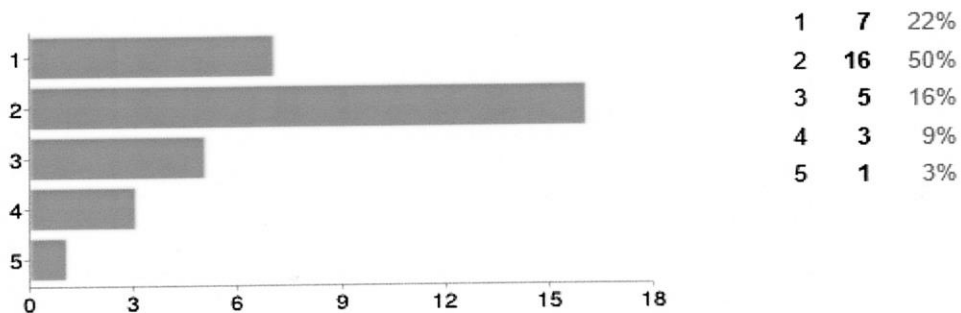


Figure 7.43: Other parameters

(2) Which of the following parameters is most important for Agility or Interoperability (ability to change cloud service provider) requirements of your business? (Rate on a scale of 1-5, 5 being most important)

Agility indicates the impact of a service upon a client's ability to change direction, strategy, or tactics quickly and with minimal disruption. The most important parameters are indicated as Extensibility of new services and features (85%), Flexibility to add or remove features (82%), Scalability of services by CSP (69%), Elasticity of service provider (62%), and Adaptability of service provider (60%). However, less importance has been observed for Portability of service from one CSP to another (47%), and Other parameters (16%). Graphical representations of the responses for these parameters are given below:

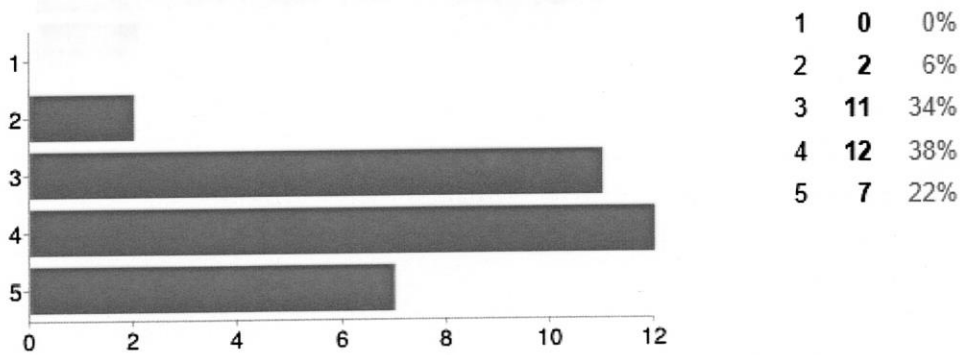


Figure 7.44: Adaptability of service provider

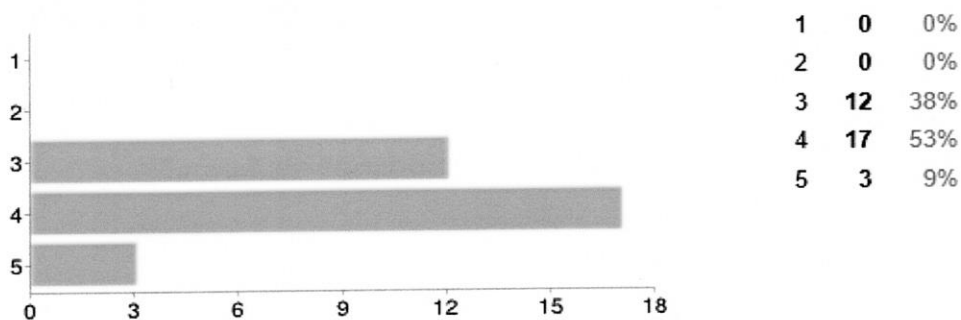


Figure 7.45: Elasticity of service provider

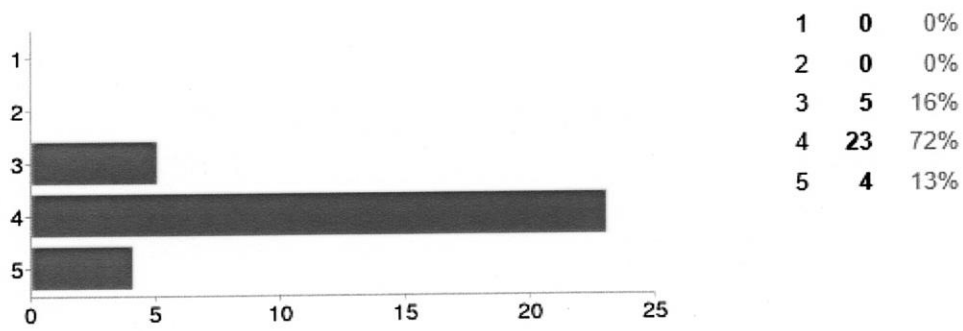


Figure 7.46: Extensibility of new services and features

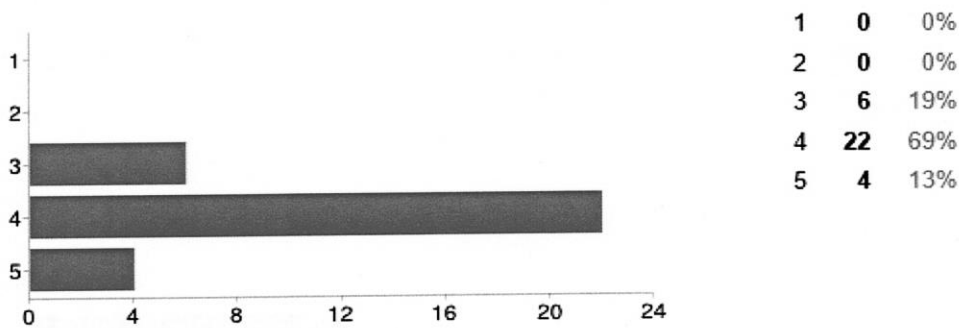


Figure 7.47: Flexibility to add or remove features

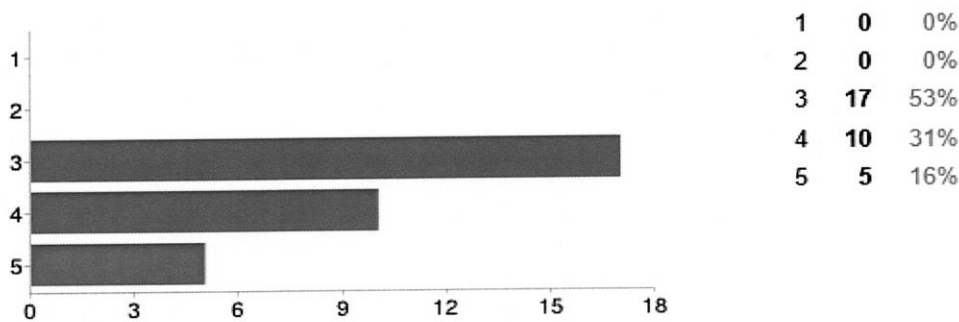


Figure 7.48: Portability of service from one CSP to another

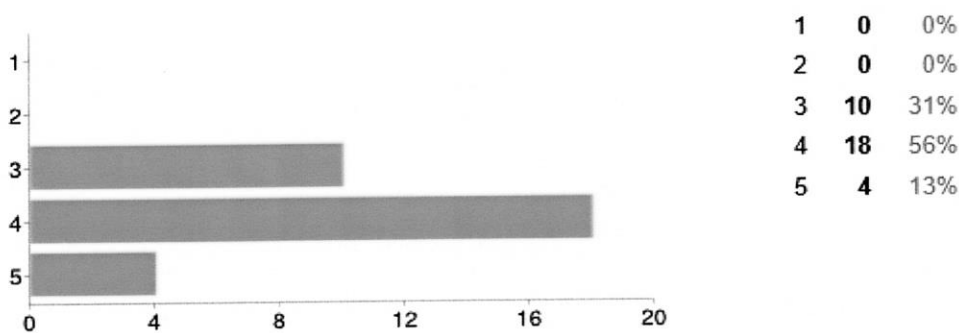


Figure 7.49: Scalability of services by CSP

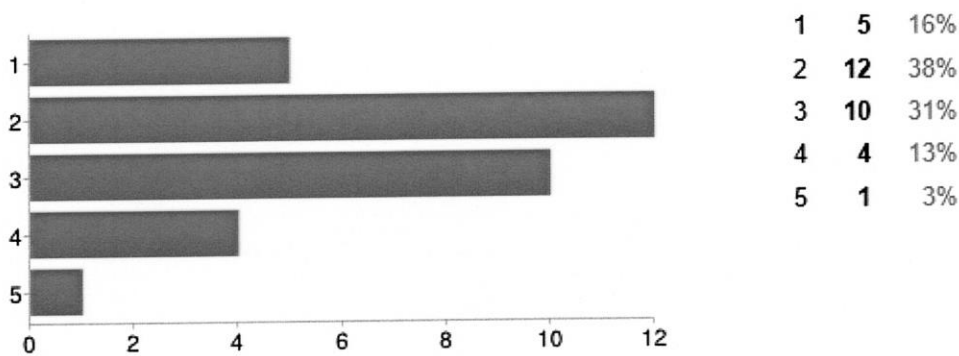


Figure 7.50: Other parameters

(3) Which of the following parameters is most important for your Assurance of availability of services by Cloud Service Provider? (Rate on a scale of 1-5, 5 being most important)

Assurance includes key attributes that indicate how likely it is that the service will be available as specified. The most important parameters are indicated as Availability of services (97%), Maintainability of services (91%), Recoverability of services (91%), Reliability of services (91%), Serviceability of performance (85%), Resiliency/Fault tolerance (84%), and Service stability to change (75%). However, less importance has been given for other parameters (19%). Graphical representations of the responses for these parameters are given below:

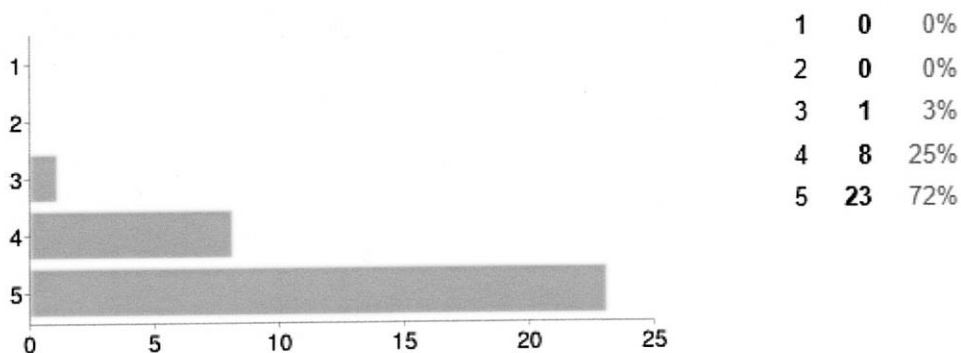


Figure 7.51: Availability of services

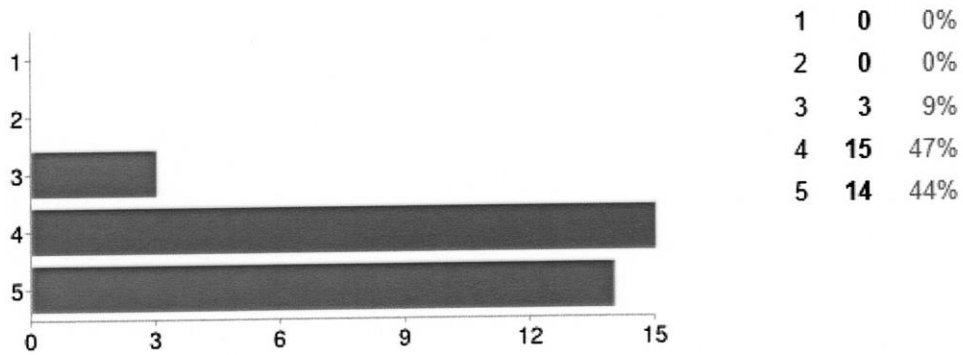


Figure 7.52: Maintainability of services

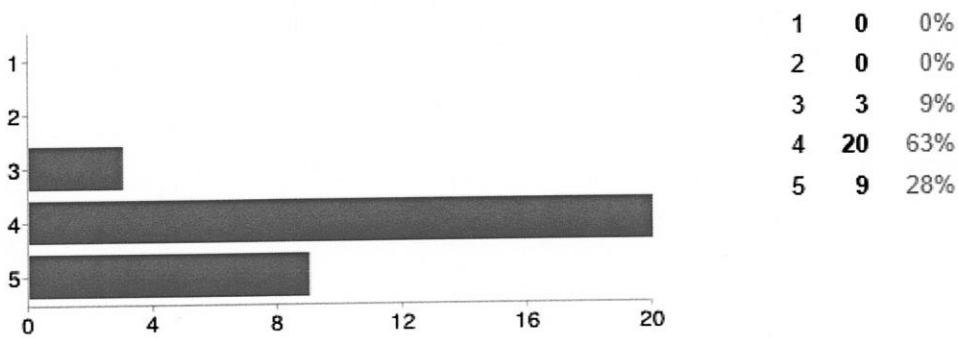


Figure 7.53: Recoverability of services

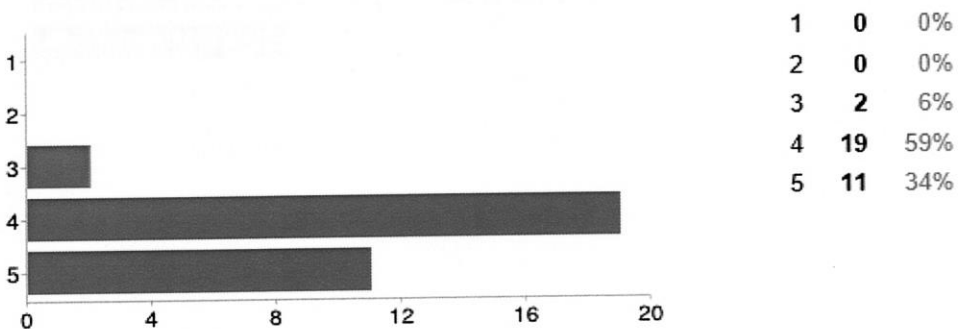


Figure 7.54: Reliability of services

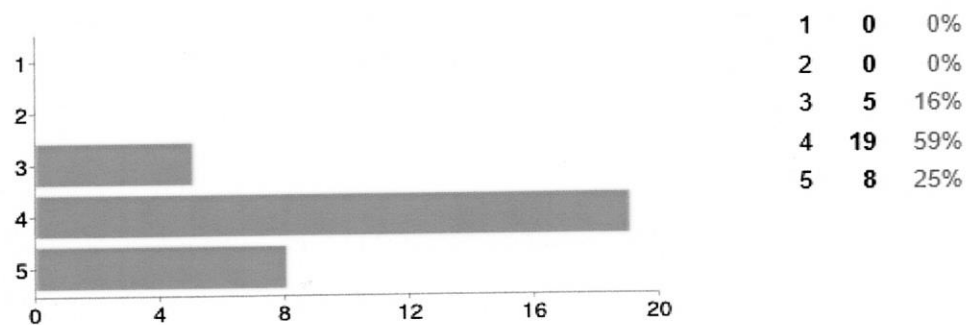


Figure 7.55: Resiliency / Fault tolerance

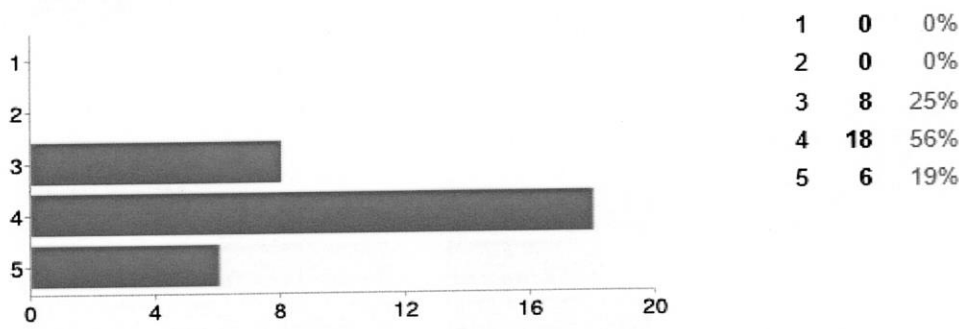


Figure 7.56: Service stability to change

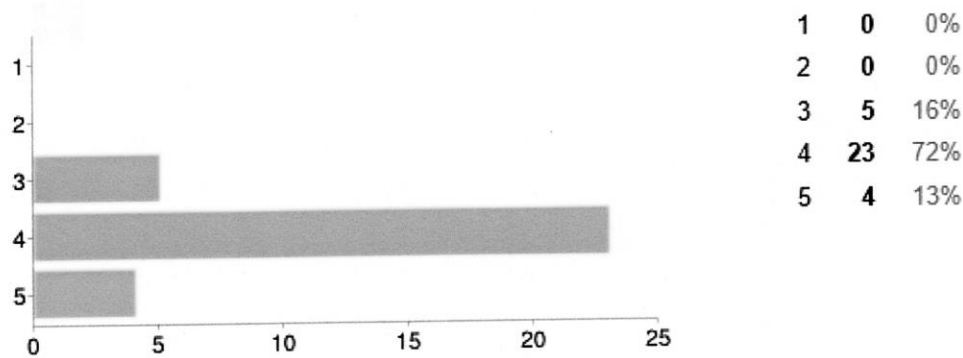


Figure 7.57: Serviceability of performance

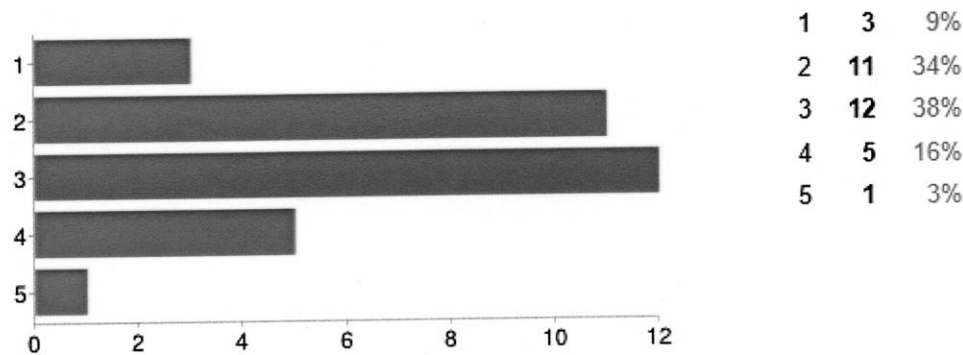


Figure 7.58: Other parameters

(4) Which of the following parameters is most important from Financial point of view? (Rate on a scale of 1-5, 5 being most important)

The most important financial parameters are indicated as Cost (100%), Financial structure (97%), Financial agility (94%), and Billing process (88%). However, less importance has been observed for Other parameters (19%). Graphical representations of the responses are given below:

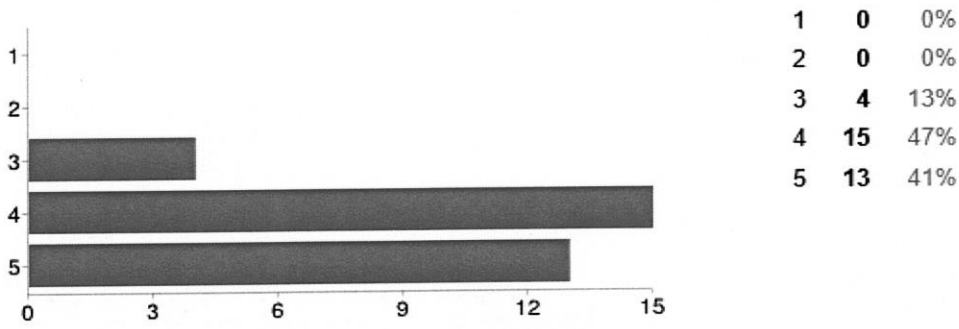


Figure 7.59: Billing process

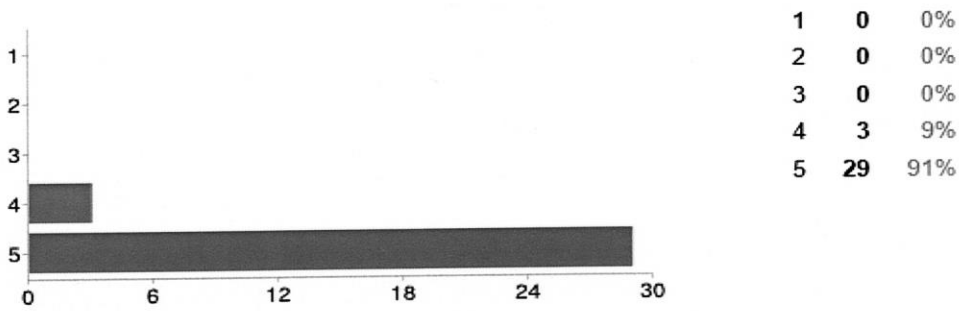


Figure 7.60: Cost

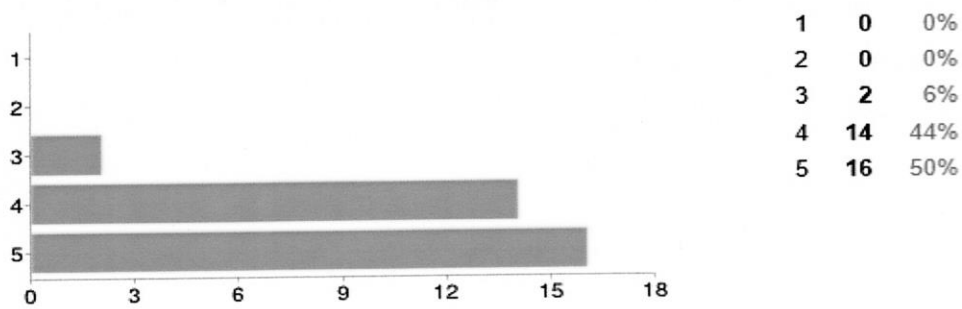


Figure 7.61: Financial agility

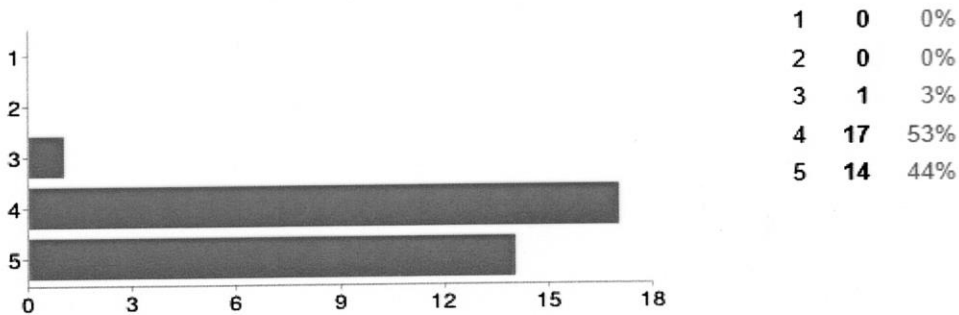


Figure 7.62: Financial structure

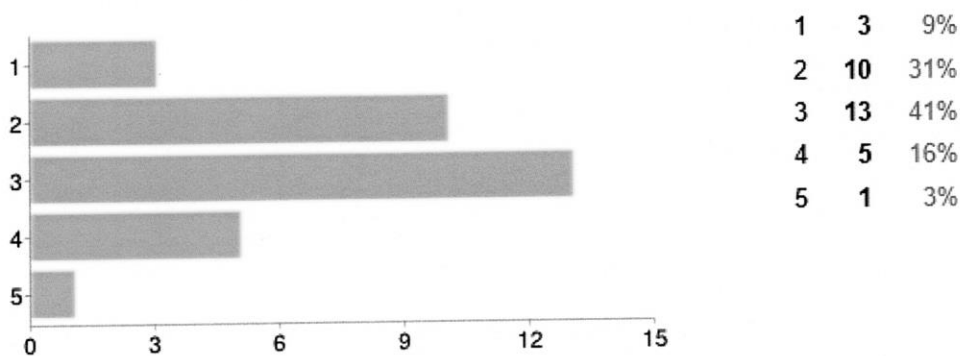


Figure 7.63: Other parameters

- (5) Which of the following parameters is most important from Performance of service provider point of view? (Rate on a scale of 1-5, 5 being most important)

Performance covers the features and functions of the provided services. The most important parameters from performance of service provider point of view are indicated as Service response time (100%), Accuracy of services as per SLA (94%), Functionality of features (94%), Suitability of features (94%), and Interoperability features (72%). However, less importance has been observed for Other parameters (19%). Graphical representations of the responses for these parameters are given below:

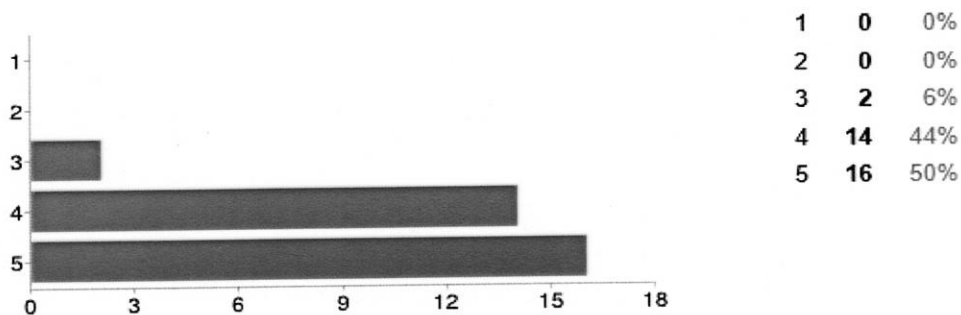


Figure 7.64: Accuracy of services as per SLA

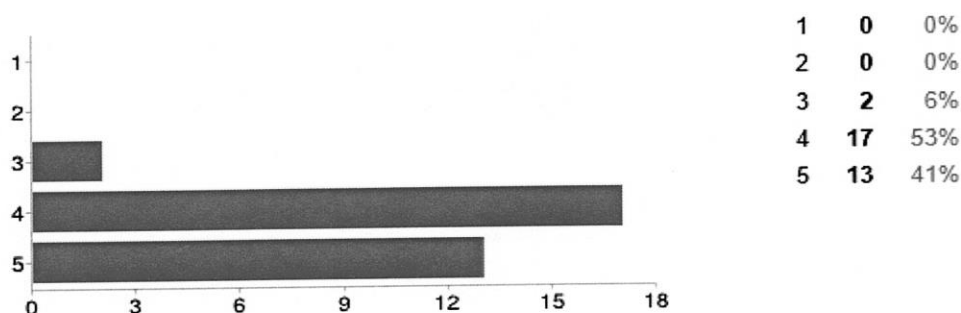


Figure 7.65: Functionality of features

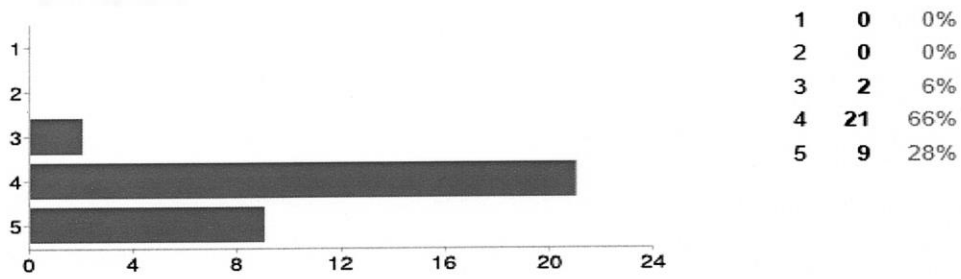


Figure 7.66: Suitability of features

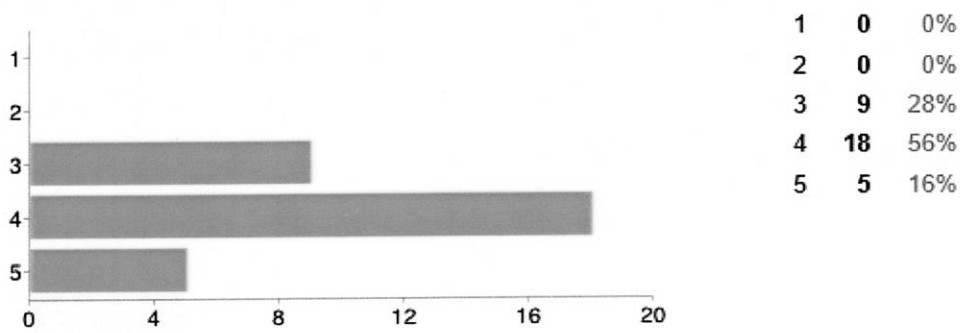


Figure 7.67: Interoperability features

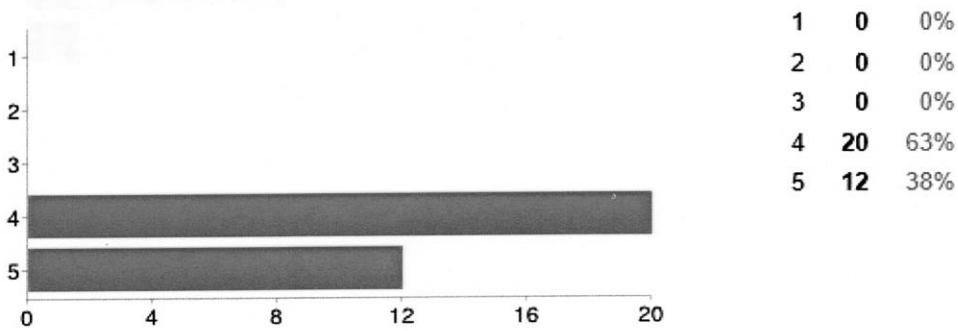


Figure 7.68: Service response time

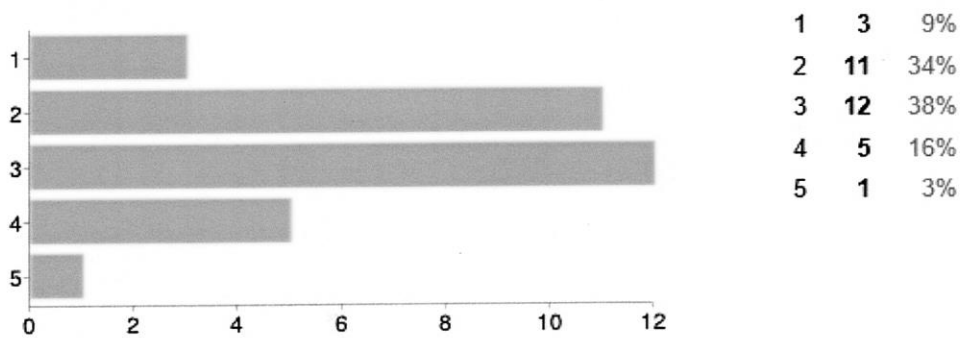


Figure 7.69: Other parameters

(6) Which of the following parameters is most important from Security and Privacy point of view? (Rate on a scale of 1-5, 5 being most important)

Security and privacy category includes attributes that indicate the effectiveness of a cloud service provider's controls on access to services, service data, and the physical facilities from which services are provided. The most important parameters from security and privacy point of view are indicated as Security management (69%), Access control and privilege management (66%), Physical and environmental security (60%), and Data integrity (54%). However, less importance has been observed for Data privacy and data loss (38%), Data location (32%), Data retention and disposition (32%), Proactive threat and vulnerability management (28%), and Other parameters (16%). Graphical representations of the responses for these parameters are given below:

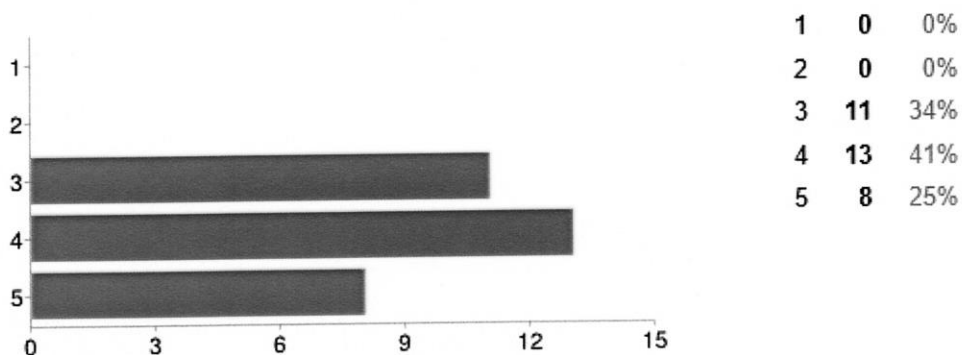


Figure 7.70: Access control and privilege management

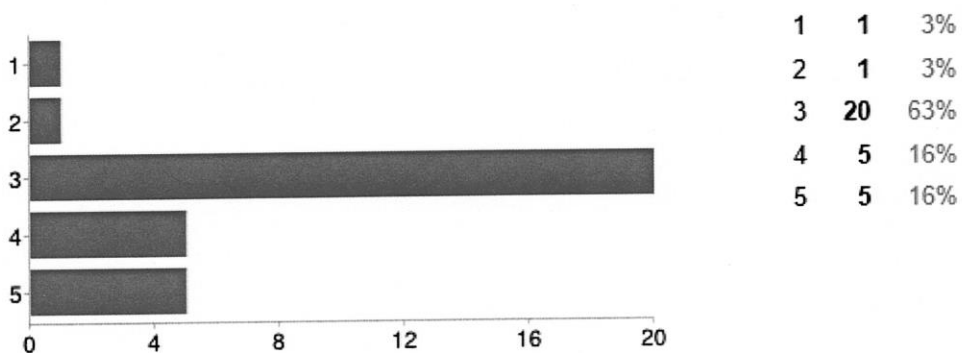


Figure 7.71: Data location

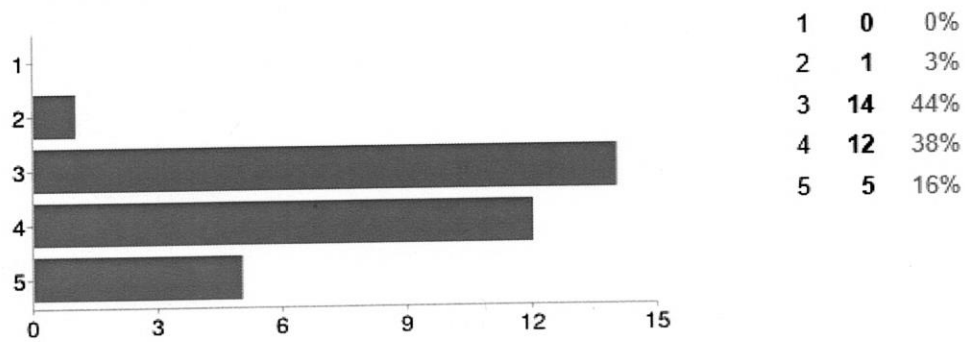


Figure 7.72: Data integrity

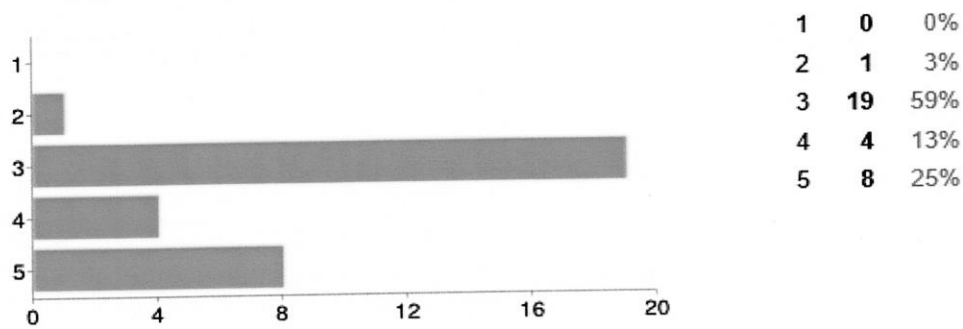


Figure 7.73: Data privacy and data loss

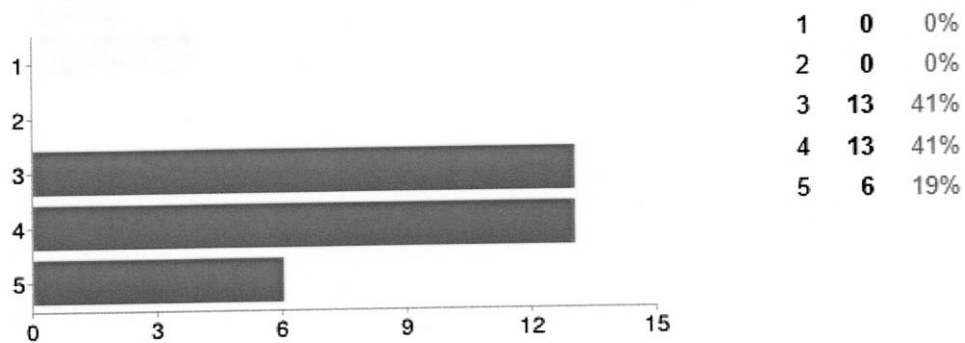


Figure 7.74: Physical and environmental security

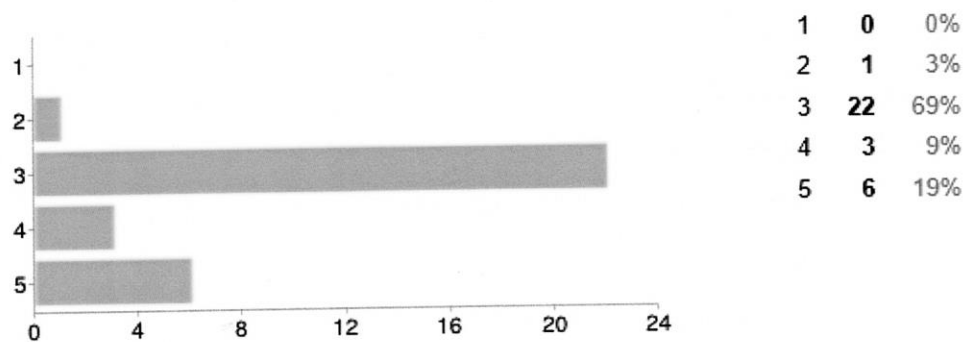


Figure 7.75: Proactive threat and vulnerability management

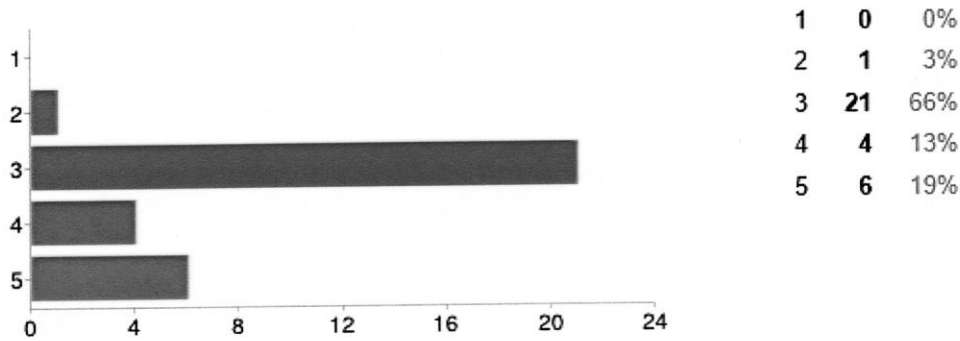


Figure 7.76: Data retention and disposition

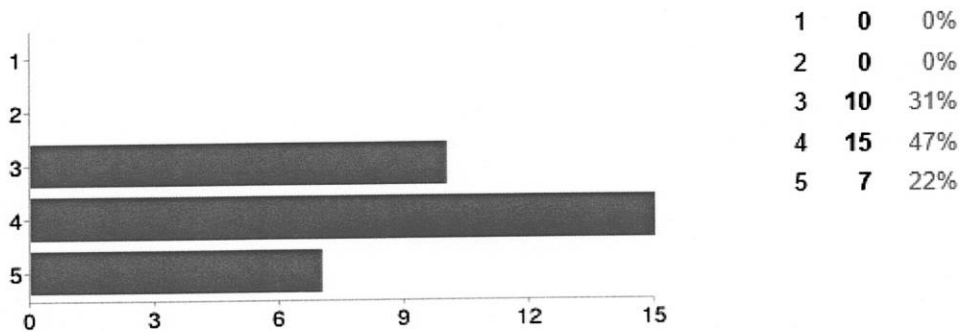


Figure 7.77: Security management

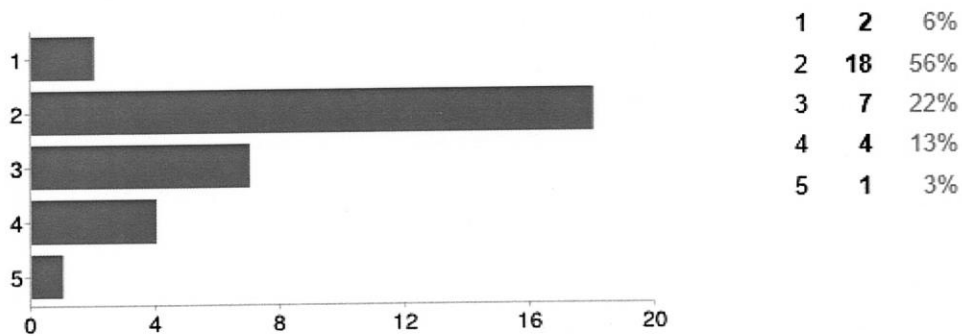


Figure 7.78: Other parameters

- (7) Which of the following parameters is most important from Usability of services point of view? (Rate in scale of 1-5, 5 being most important)

Usability includes attributes that indicate the ease with which a service can be used. The most important parameters from usability point of view are indicated as Ease of installation of services (97%), Ease of learning of services (97%), Ease of operation of services (97%), Transparency (97%), Understandability of services (97%), Client personnel requirements (85%), and Accessibilities even

with disabilities (56%). However, less importance has been observed for Other parameters (22%). Graphical representations of the responses for these parameters are given below:

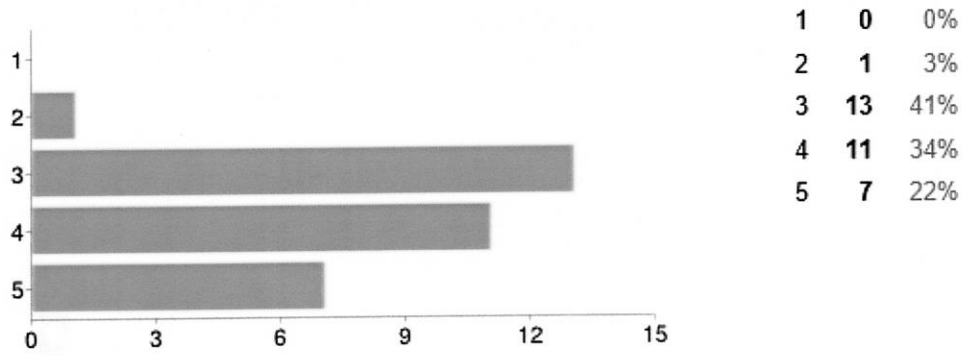


Figure 7.79: Accessibilities even with disabilities

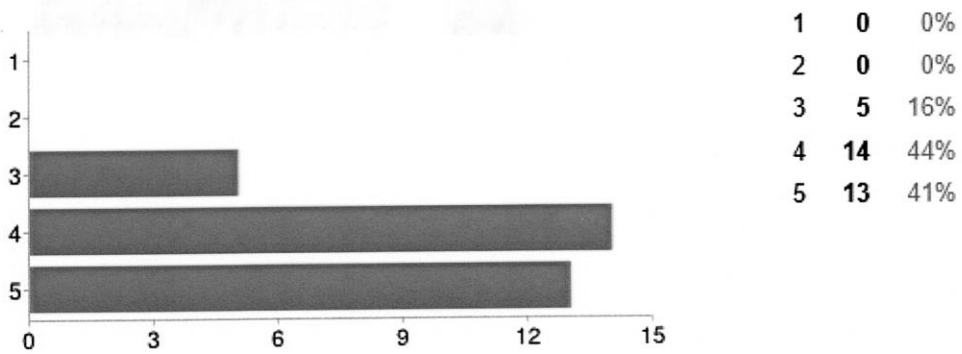


Figure 7.80: Client personnel requirements

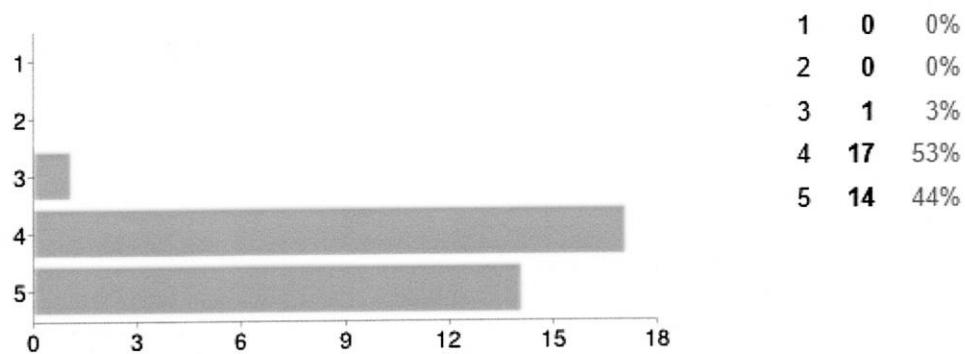


Figure 7.81: Ease of installation of services

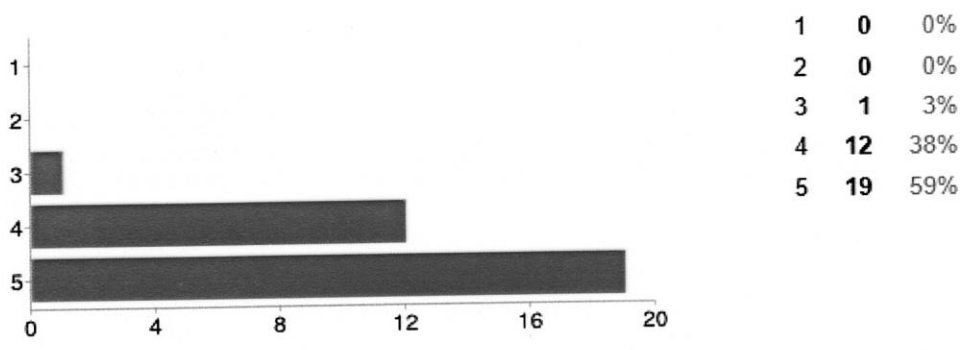


Figure 7.82: Ease of learning of services

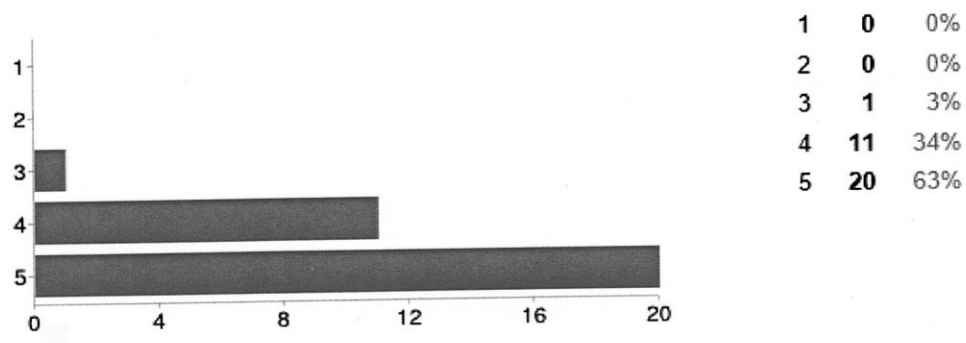


Figure 7.83: Ease of operation of services

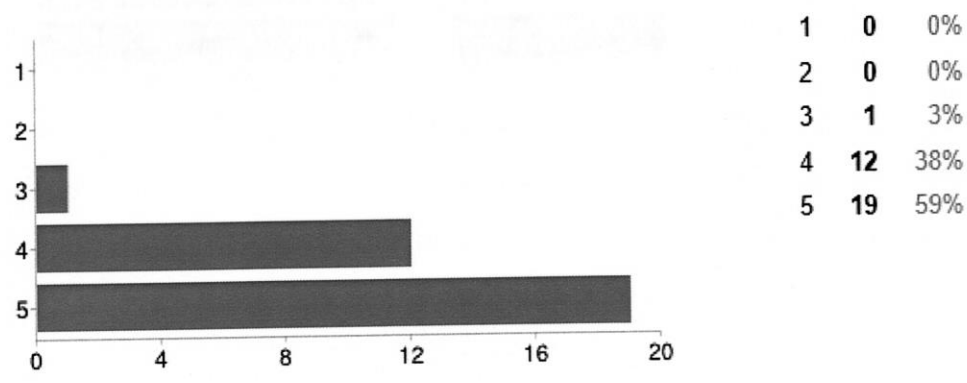


Figure 7.84: Transparency

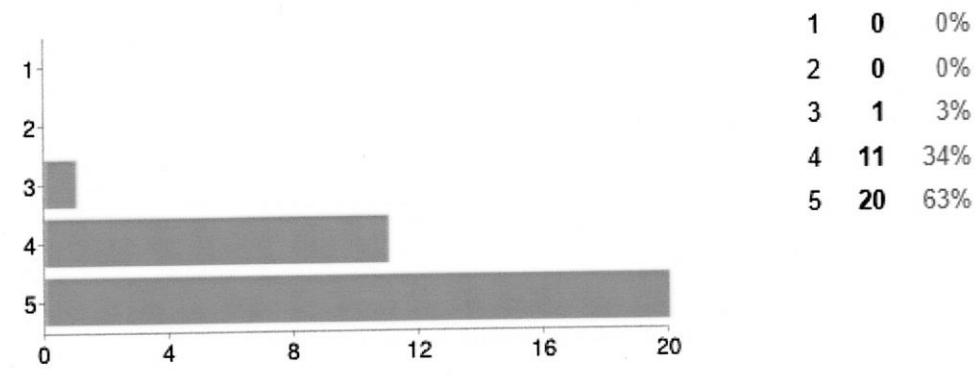


Figure 7.85: Understandability of services

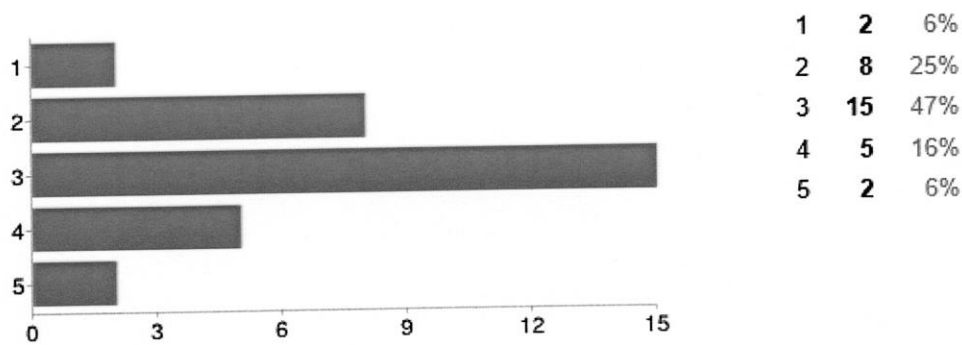


Figure 7.86: Other parameters

- (v) What are your other expectations from the Service level Agreements in addition to the important parameters as indicated above? (Rate on a scale of 1-5, 5 being most important)

The most important other expectations in addition to the important parameters as indicated above from service level agreement are indicated as Clarity of terms and conditions (100%), Grievance redressal mechanism (100%), Metering and billing accuracy (97%), Transparency in billing (97%), Strict penal provisions for non compliance by a service provider (88%), and Comparability of terms and conditions of different service providers (81%). However, less importance has been observed for Improvement in real time threat detections and protection (41%), and Other parameters (16%). Graphical representations of the responses for these parameters are given below:

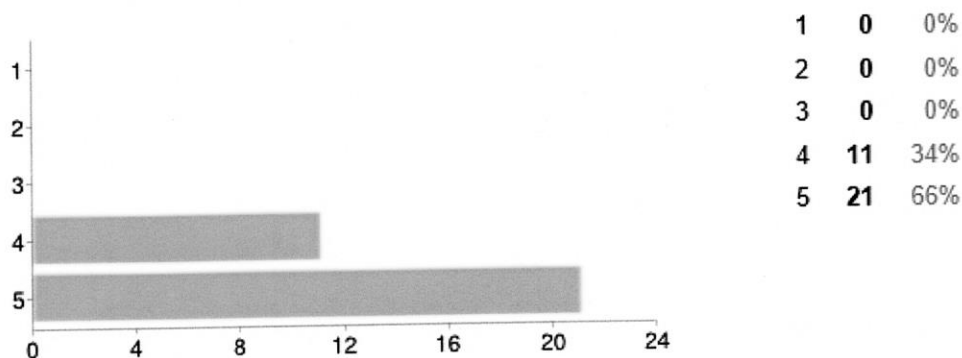


Figure 7.87: Clarity of terms and conditions

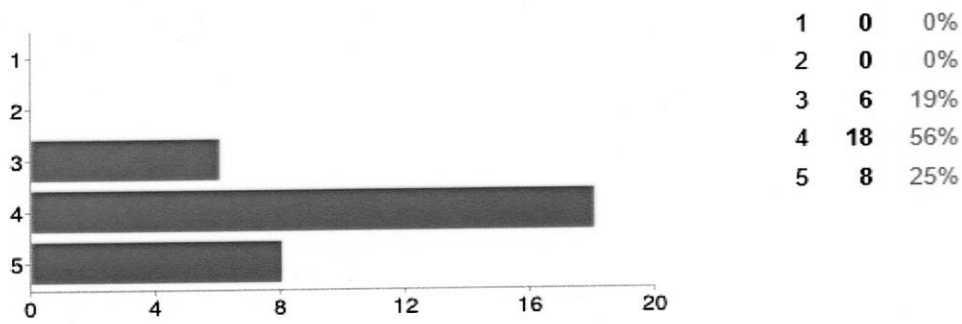


Figure 7.88: Comparability of terms and conditions of different service providers

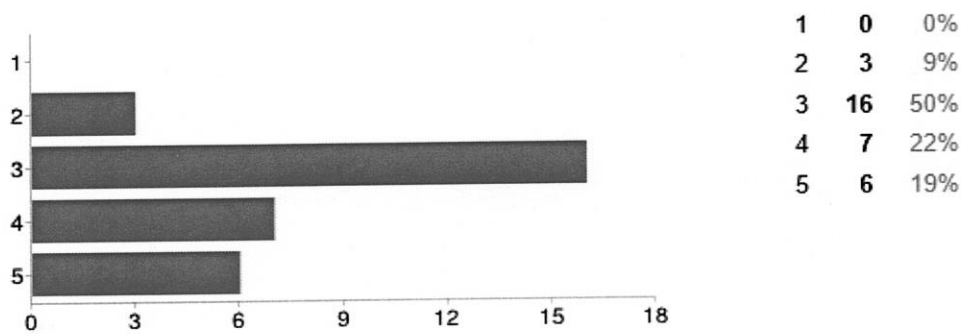


Figure 7.89: Improvement in real time threat detections and protection

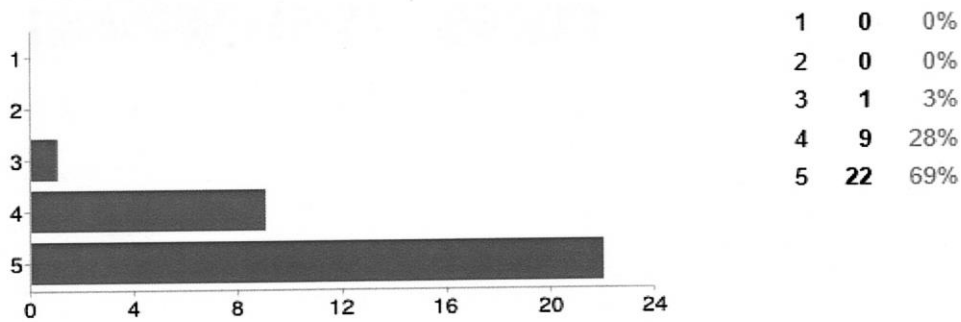


Figure 7.90: Metering and billing accuracy

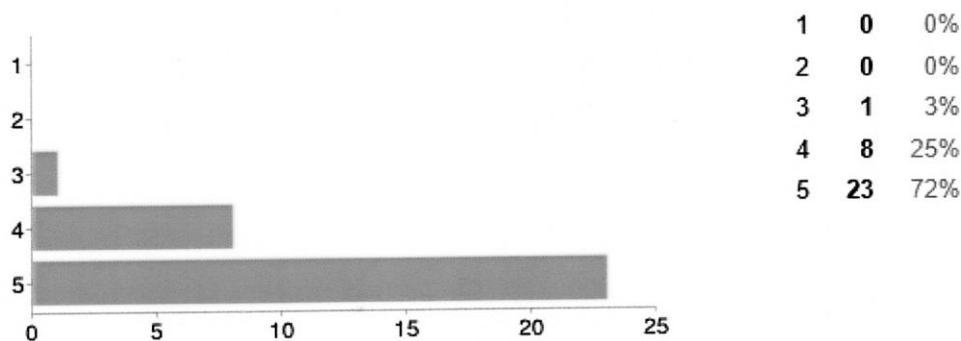


Figure 7.91: Transparency in billing

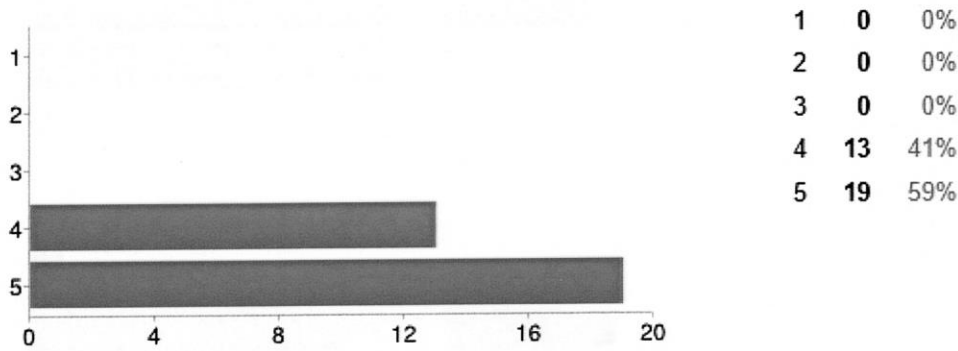


Figure 7.92: Grievance redressal mechanism

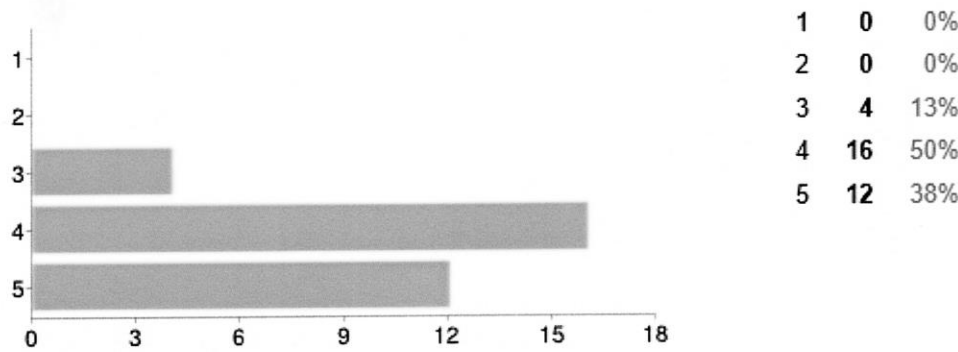


Figure 7.93: Strict penal provisions for non compliance by a service provider

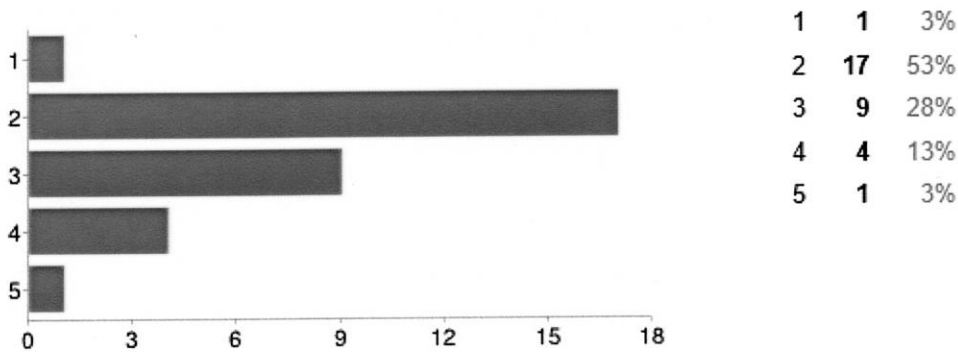


Figure 7.94: Other parameters

(vi) Which of the following parameters is most important hindrance for adoption of cloud? (Rate on a scale of 1-5, 5 being most important)

The most important hindrances for adoption of cloud are indicated as Issues with third party technology acquisition and data integration (91%), Unclear scheme in pay per use approach (90%), Unclear advantages of adoption of Cloud (88%), and Issues with interaction with the existing infrastructure (84%). However, less importance has been observed for Non availability of reliable

telecom connectivity at client's locations (47%), Non availability of reliable power supply at client's locations (15%), and Other parameters (9%). Graphical representations of the responses for these parameters are given below:

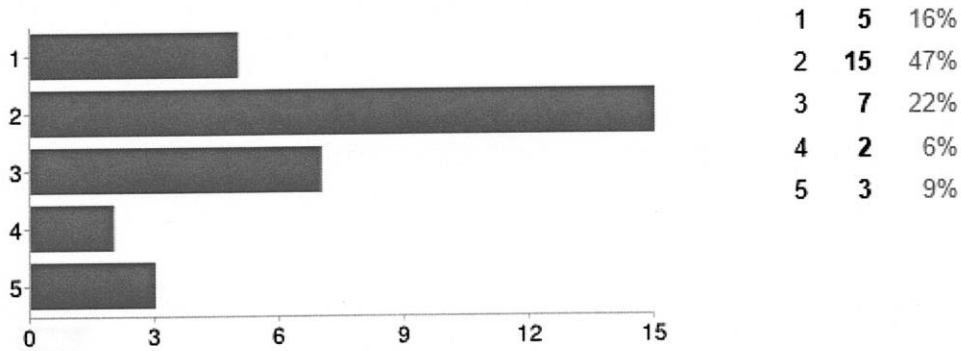


Figure 7.95: Non availability of reliable power supply at client's locations

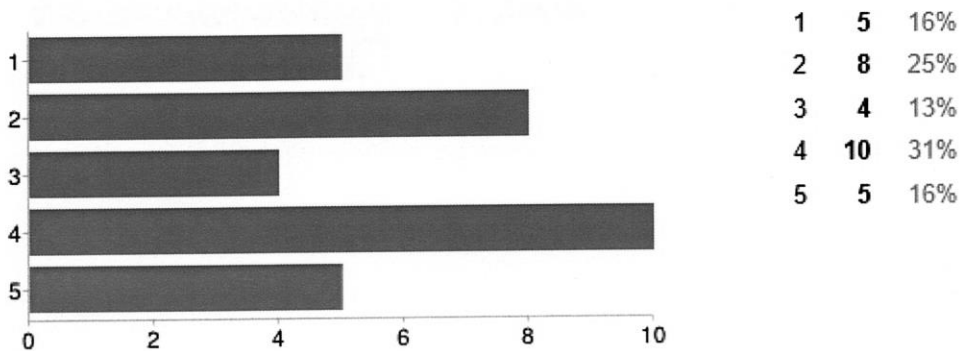


Figure 7.96: Non availability of reliable telecom connectivity at client's locations

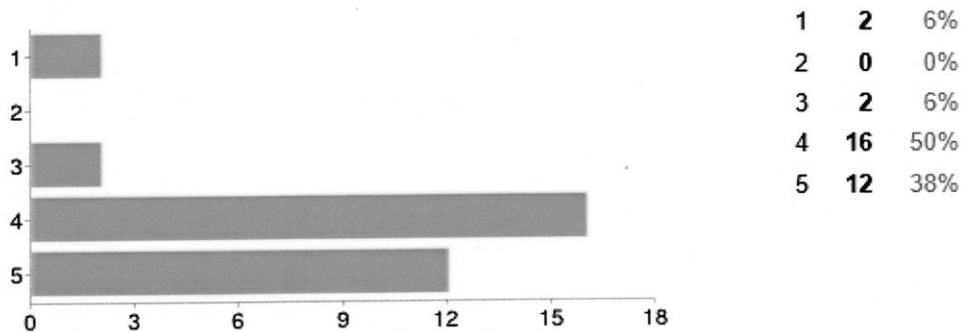


Figure 7.97: Unclear advantages of adoption of Cloud

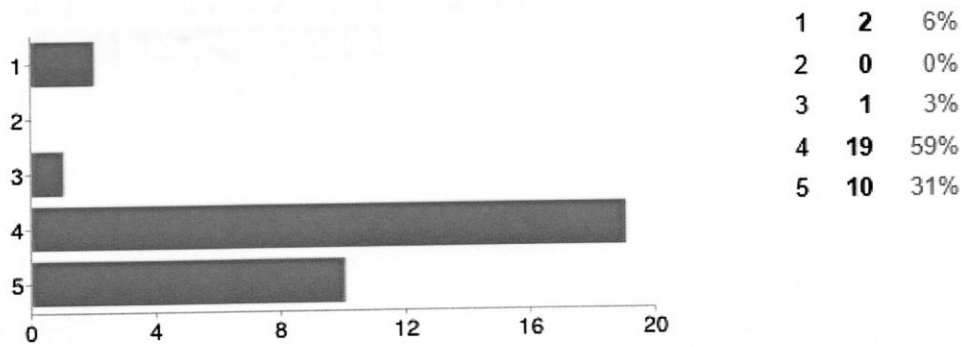


Figure 7.98: Unclear scheme in pay per use approach

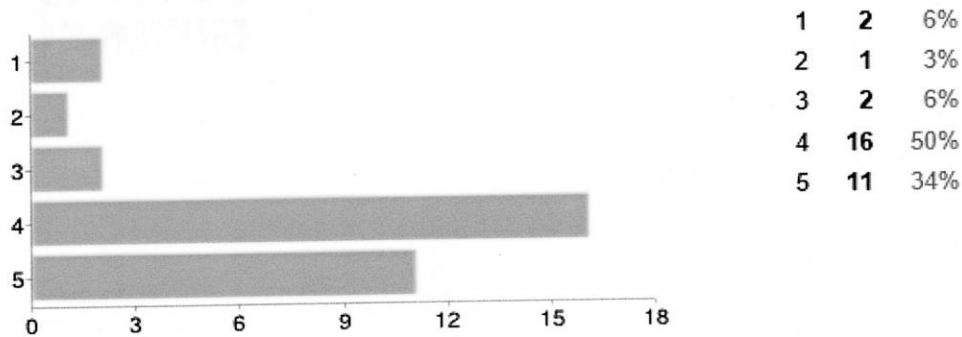


Figure 7.99: Issues with interaction with the existing infrastructure

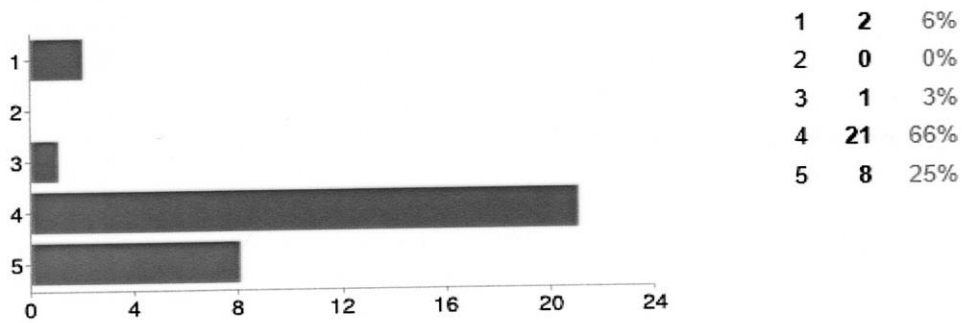


Figure 7.100: Issues with third party technology acquisition and data integration

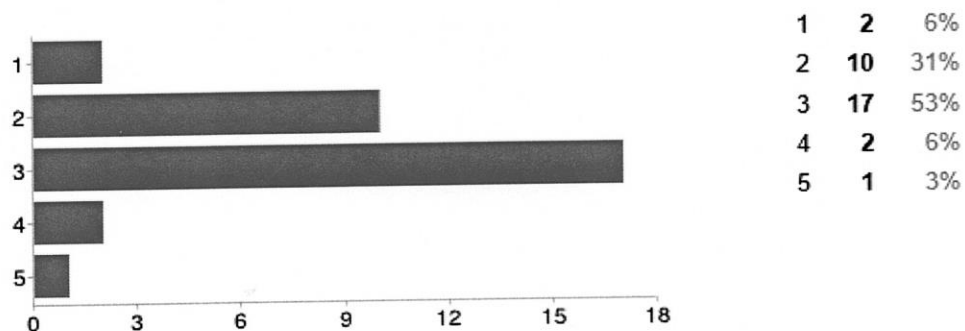


Figure 7.101: Other parameters

(vii) Which of the following parameters is most important for increasing adoption of cloud? (Rate on a scale of 1-5, 5 being most important)

The most important parameters for increasing adoption of cloud are indicated as Increasing level of awareness of advantages of adoption of cloud (100%), Monitoring of services offered by cloud service providers (97%), Establishing a grievance redressal mechanism for protecting interests of clients (97%), Integration with mobile platforms (97%), Auditing of services of service provider by independent agency (94%), Governance mechanism to monitor services offered by cloud service providers (93%), Compliance with local and global regulations (72%), and Focused approach to increase reliable telecom network connectivity (53%). Graphical representations of the responses for these parameters are given below:

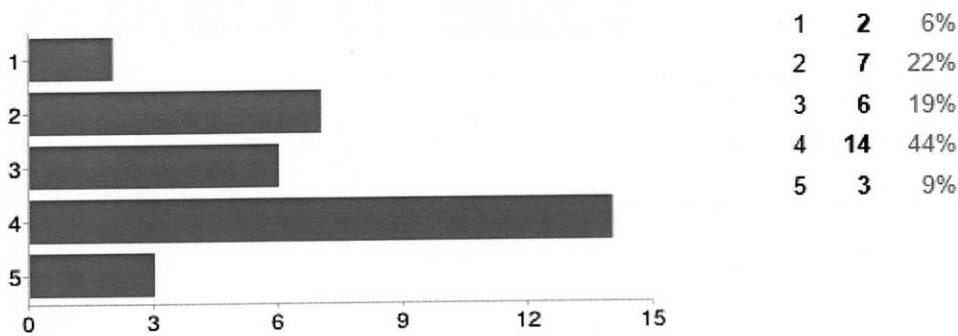


Figure 7.102: Focused approach to increase reliable telecom network connectivity

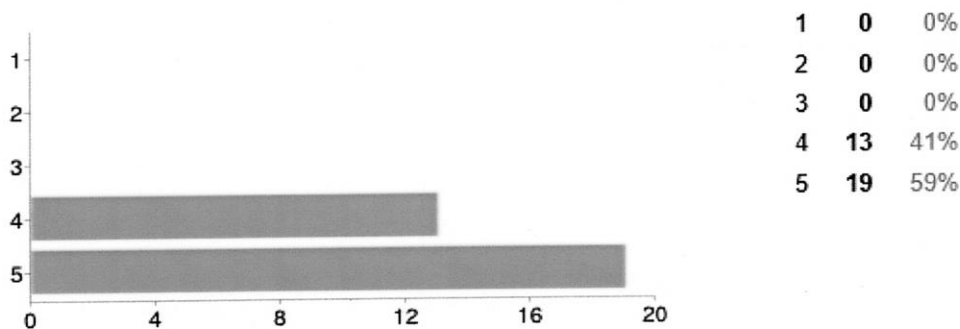


Figure 7.103: Increasing level of awareness of advantages of adoption of cloud

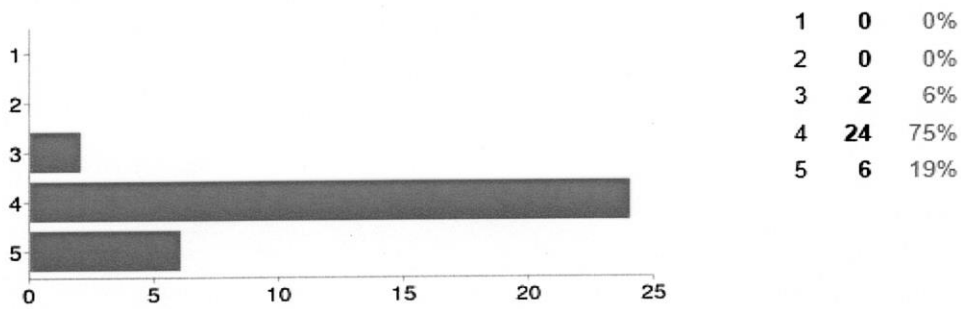


Figure 7.104: Auditing of services of service provider by independent agency

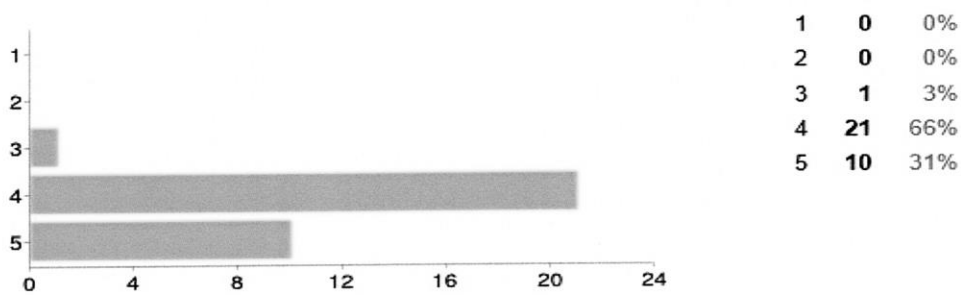


Figure 7.105: Monitoring of services offered by cloud service providers

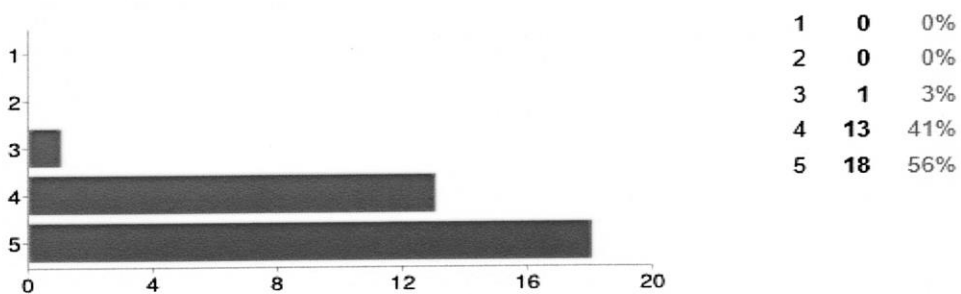


Figure 7.106: Establishing a Grievance redressal mechanism for protecting interests of clients

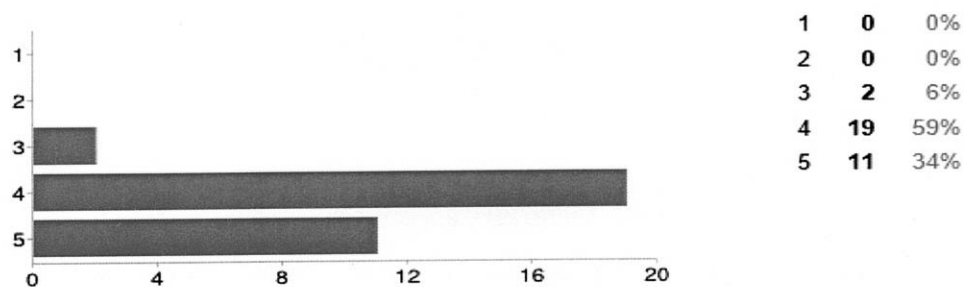


Figure 7.107: Governance mechanism to monitor services offered by cloud service providers

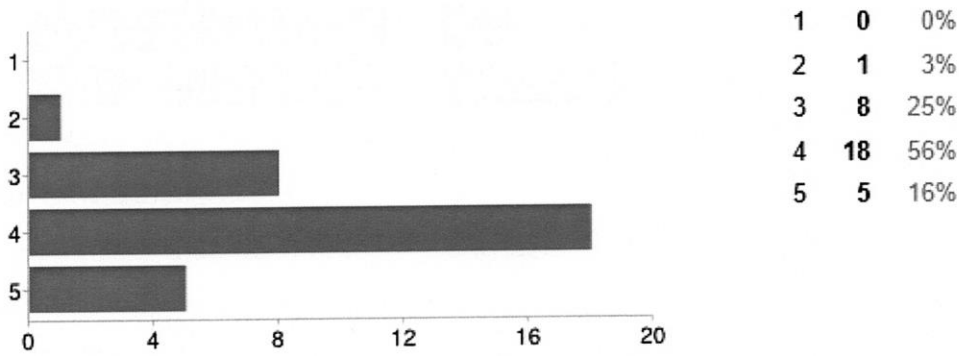


Figure 7.108: Compliance with local and global regulations

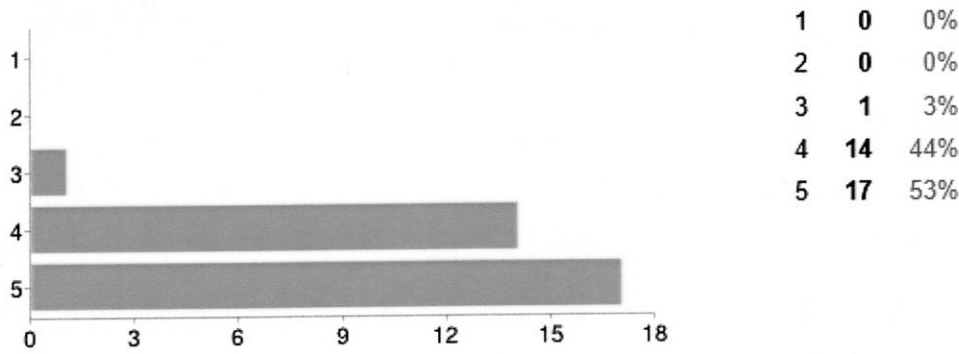


Figure 7.109: Integration with mobile platforms

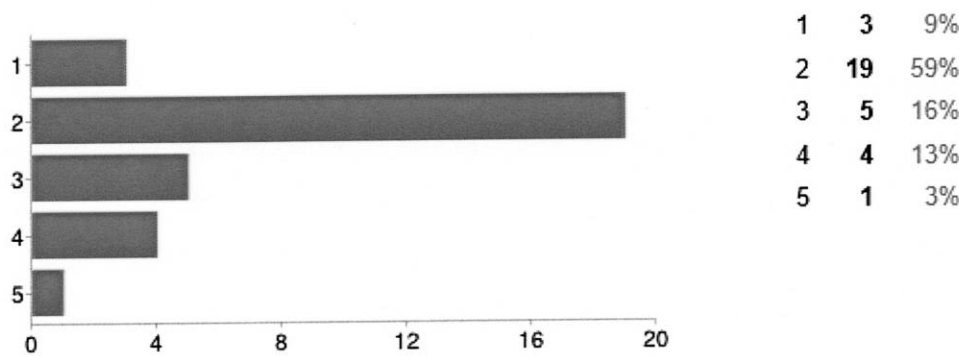


Figure 7.110: Other parameters

7.3 Recommendations

Based on the responses received from SMEs in response to the questionnaire, some recommendations are put forth to overcome the challenges to adoption of cloud and for faster adoption of cloud by SMEs in India.

7.3.1 Establishing a governance mechanism for faster adoption of cloud

The adoption of cloud computing by SMEs has been continuously increasing in India, though at a slower pace, during the past few years and needs to be further encouraged. However, for private cloud offerings there is no generalised and documented eco-system in place. It might be a good idea to establish a **governing mechanism** on the lines of an autonomous body like National Highway Authority of India (NHAI) so as to work as a facilitator, coordinator and monitoring agency for different issues related to adoption of cloud. This agency could play a pivotal and focused role for speeding up the process of cloud adoption and bridging the urban rural divide therein.

Presently, there is no platform to find/select cloud providers. Hence, it is recommended that all the cloud service providers may be asked to register themselves with this agency and to declare various services offered by them. This information shall be placed in public domain through website so as to facilitate a prospective client to quickly get a comprehensive list of cloud service providers in the interested region for further interactions. This will also promote the new cloud service providers to innovate and offer new services to prospective clients.

However, it may be argued that the IT sector in India has been the fastest growing sector and there is no such mechanism. But, the difference here is that cloud adoption is expected to benefit the most only when it reaches the widely spread SMEs of the country and is able to meet their personalized requirements whereas in case of IT solutions it has been mostly off the shelf packages for small businesses without any customization needs. Hence, special attention is required to be given to facilitate cloud adoption by SMEs.

7.3.2 Provision for comparability of performance for quality of service parameters

The service providers keep a record of the performance with respect to the different Quality of Service (QoS) parameters of SLA signed with the client. However, there is no mechanism available to the clients to evaluate and compare different service providers based on some QoS parameters. The **governing**

mechanism set up as per recommendation may ask all the service providers to declare their record keeping for different Quality of Service parameters. The record keeping procedures shall then be studied further and a uniform record keeping procedure shall be prescribed for all the service providers. Periodic reporting of the performance against quality of service parameters may also be started. The service providers may subsequently be mandated to publish information relating to their quality of service performance for information of the consumer.

Such **governing mechanism** may also be required to prescribe and streamline calculations of different parameters. For example, for availability calculations, cloud services providers use multiple different ways for calculating service availability metrics depending on the service provided. A common practice is to divide the entire SLA period into measurement intervals of 2, 5, 15 or 60 minutes, then deciding on a service availability flag or score for each interval, and then aggregating over the total SLA period.

The data relating to cloud service providers for a particular service and the technical performance will be available to the clients through a single website which will facilitate the task to select a service provider to a great extent and shall promote the new service providers as well. The financial terms and conditions of different service providers can be then compared by the client on individual basis.

7.3.3 Establishing a grievance redressal mechanism for protecting interests of clients

Cloud environment provides the ability to source components from different service providers to give a virtual aggregated solution to the end client. A SaaS service provider may be using the services of a PaaS service provider who in turn may be using infrastructure from an IaaS provider. In such a case, it is essential to define a mechanism for redressal of quality related issues arising anywhere in the chain. The end client shall not suffer because of the Quality of Provider's Service Provider. It may be beneficial to tie the IaaS/PaaS/SaaS providers into a tri-partite contract with the customer such that the SaaS provider

is the single point of contact for quality issues and shall be responsible to the end customer. Back to back contracts if done by IaaS, PaaS and SaaS providers shall not result in to "it's not my fault syndrome" and the end client shall get services as per agreement with the SaaS or highest layer service provider.

In addition to the support extended by the Cloud service provider to end users in compliance of SLA, service providers may provision a self service portal as an extended customer support. However, a cloud service grievance portal could also be setup at the website of the **governing mechanism** where a link to the website of the service provider could be provisioned. The client shall be able to register his grievance through this website with the service provider. An escalation matrix within the service provider may be established for resolution of grievance. However, if the grievance is not settled within a reasonable timeframe, the client may request **governing mechanism** to intervene.

7.3.4 Increasing level of awareness of advantages of Cloud

Such **governing mechanism** as proposed earlier shall undertake customer outreach programmes, seminars and workshops through various Central/State government setups and SME associations to spread awareness about advantages of adoption of Cloud such as easy scalability and availability on demand including financial benefits such as pay per use and resultant cost savings. Mass awareness through advertisements shall also be explored.

7.3.5 Auditing of services of service provider by independent agency

Cloud is a pure utility renting computing model, where the resources can be utilized as per the need of the client. In such a scenario the accounting of resources used and billed needs to be substantiated by the cloud service provider by preserving the complete logs and all such other details which are essential for the complete satisfaction of the client. The satisfaction of the client with the billing performance may comprise of timely receipt of the bill, accuracy and completeness of the bill, clarity in bills/presentation of the billing information in terms of transparency and understandability, and the process of resolution of billing complaints. The **governing mechanism**, as established, may ask every

service provider to submit a metering and billing audit, carried out by an independent agency on an annual basis. Similarly, a technical audit of the service providers may be done on an annual basis by an independent agency appointed by it.

7.3.6 Strict penal provisions for non compliance by a service provider

In case deviations are observed during the audit process, remedial actions shall be taken by the service provider so as to protect the interests of the clients. However, in case of wilful and intentional lapses or on repeat deviations on part of service provider, strict penal provisions are required to be explored to be put in place.

7.3.7 Evolution of regulations and compliance with local and global regulations

Despite ongoing efforts worldwide, a common and harmonized legal framework is not yet in place. No country has dedicated cloud computing regulation or legislation. Vendors still need to face local regulations that often restrict the free flow of information between countries. The key areas where the legislation remains insufficient are related to security (sensitive data), ownership and location of data, confidentiality, and intellectual property. The future state of the legislation is still uncertain and it represents a considerable limitation as the Cloud continues to permeate borders.

Legal and Regulatory framework is important for the orderly growth of the industry and to create confidence in the consumers. Regulations should be in place to protect the interest of both the cloud service providers and the consumers. Legal framework under which the cloud operates becomes very important as the application of old law to new technologies can be unpredictable and often unsatisfactory.

It is seen that the existing laws in India are disjointed and are not specifically applicable to cloud computing. While these laws do cover some legal issues thrown up by cloud computing, they don't contemplate the scope of cloud

computing services and the resultant magnification of these issues. The consequence of this state of affairs is that the current laws would possibly have the effect of being restrictive rather than facilitative to cloud computing and call for specific regulation whereby any emergent issues can be dealt with directly and effectively. The acts and regulations are to be evolved for cloud computing in India for Regulation of Investigatory Powers, Regulation on Stored Communication, Mandatory guidelines for National Security for cloud operation and Lawful interception and monitoring by Law Enforcement Agencies, Privacy Laws etc.

7.3.8 Tax Subsidies

In India, various incentives exist for specific industries such as power, ports, highways, electronics and software or incentives for units in less-developed regions or incentives for units producing in export processing zones and SEZs. Such Incentives include the following:

- Tax holidays, depending on the industry and region;
- Weighted deductions at 200% for in-house research and development (R&D) expenses, including capital outlays (other than those for land) in the year incurred. Companies could also claim a deduction for expenses incurred in the three years immediately preceding the year in which the company commenced business;
- Accelerated depreciation for certain categories, such as energy saving, environmental protection and pollution control equipment;
- Extension of medium and long term loans by the central government's development banks and the state industrial development banks and sometimes they took equity in new projects as well;
- Software companies were granted a tax holiday on income generated, under Sections 10A and 10B of Indian tax laws, out of Software Technology Park of India (STPIs) – a concession that brought down the effective tax rates to 12-15 percent, compared with the peak effective corporate tax of 33 per cent.

Similar incentives could also be extended to the cloud service providers to enhance these services and to bring them to the level playing field with international competitors as such similar incentives are being provided in different countries.

7.3.9 Issues with third party technology acquisition and data integration

These issues mainly arise because of dependency of cloud service providers on external providers. Lack of large IaaS provider(s) base and better developed cloud infrastructures and comparatively weak development of new (cloud) integration technologies aggravates issues with regard to integration with the existing infrastructure. A significant number of the hereditary network elements are working on proprietary application protocol interfaces (API) for which interfaces or open source technologies are required to be deployed. However, growing interest from both industry and academia in cloud technologies is fuelling development for connecting such network elements to cloud.

Frequent interactions by the **governing mechanism** with the IT developer community, academia, cloud service providers and clients to focus on the major integration issues are likely to resolve these issues to a large extent.

7.3.10 Integration with mobile platforms

India has a strong telecommunication industry with consumer focus, investment capabilities and research aptitude. It also has significant expertise in building high-value industry specific applications. The professionals in telecommunication field are largely from knowledge background and have expertise in related technological areas.

Cloud provides an excellent backend for mobile phone applications which have usually low power local resources. Mobile penetration in India has increased at a fast pace in recent years and with the advent of latest 3G and 4G technologies coupled with smart phones, it is in the interest of telecommunications industry to integrate mobile phones with cloud capabilities. Recognizing this requirement,

applications are already being developed for seamless and ubiquitous connectivity of mobiles with cloud. The matter may be further taken up by the **governing mechanism** with Telecommunications Equipment Manufacturers Association (TEMA) for streamlining development of applications to address such issues.

7.3.11 Focused approach to increase reliable telecom network connectivity

Cloud computing requires generalised availability of higher bandwidth quality and speed, at a reasonable price to facilitate ubiquitous access from anywhere on any device. The very real frustrations of slow and poor quality connections often cause people to not use cloud computing services and rather to revert to traditional tools which store and manage data locally – on the user's computer. The telecom service providers need to provide the required bandwidth at a reasonable price to facilitate the availability of cloud to the users.

One of the biggest challenges embracing cloud computing in India is the lack of dependable infrastructure. For Cloud computing to be successful in India, the basic data centre grade physical infrastructure i.e. Connectivity, Power and Cooling should be consistent. Also there is an utmost requirement to increase the bandwidth throughput in India. The necessary action in this regard is already planned and is being taken under Digital India and through National Optical Fibre Network (NOFN) project which need to be executed at a fast pace so as to reap the benefits of technology.

7.3.12 Focused approach to increase reliable power supply availability

A stable power supply is the basic need of Cloud computing, a single power cut may mean a huge system crash. Main challenge is to secure affordable and reliable sources of energy. The data centres which store and process data for cloud activities use great amounts of energy, but electricity is expensive, scarce and unreliable. With the grid subject to intermittent power outages, data centre operators are forced to rely on expensive diesel fuel to run backup generators. While firms have often relied on private sources of power to ensure that their

needs are met, the growth of data centres could ultimately be constrained by the weak electricity infrastructure.

Where sites are beyond the reach of an electricity grid or where the electricity supply is unreliable, and are remote enough to make regular maintenance and refuelling of diesel generators prohibitive, there are available several cost-effective subsidized alternative energy sources such as solar panels. The importance of these alternative energy sources is increasing, because of higher awareness for the green agenda and new approaches to reduce the carbon footprint.

The Government of India has already planned massive power generation strategies and is aiming to eliminate power supply shortages by year 2022 through a mix of nuclear, thermal, renewable energy including wind power and solar power generation. It is of utmost importance that the actual implementation is carried out on field well in time.

7.3.13 Innovations in cloud computing

India is well positioned to leverage the current investments of market participants because of the large presence of Multi-National Companies (MNCs) and a rapidly growing network infrastructure to establish a dominant position in the global cloud computing market. Recognizing the potential of Cloud Computing, the Indian Government should ensure that researchers and firms contribute to the framework of the cloud. The government should invest heavily in the development of cloud standards and there should be a focus on developing indigenous hardware and software to enable the cloud. There is also a requirement to incubate innovation in the cloud infrastructure space in order to be the next generation international powerhouse destination in the cloud services including e-Health, e-Education and e-Governance. There are various innovative opportunities existing namely building on top of the cloud applications, contributing to building of the cloud infrastructure, management and operation

of cloud services, research on cloud related problems for integration with other application systems, legacy support and migration to cloud.

Even in software there is a lot of scope for innovation in terms of public cloud (e-Governance, e-Education etc.) which can be led by Government using open and standard Cloud Connectors for interoperability which will incubate a new generation of cloud services. The orchestration of cloud resources and services from various cloud service providers should be futuristic approach in cloud space.

7.3.14 Periodic review of cloud computing adoption

Review of the progress made in respect of cloud adoption is required to be undertaken periodically for getting feedback, incorporating amendments and course correction so that the goals set forth by the government are achieved and the advantages of cloud computing are fully reaped.

7.4 Conclusion

While cloud computing services are being adopted by SMEs in India for the last couple of years, it still has a long way to go before the real advantages of cloud services are realized. Cloud computing must be treated as one among many instruments for increasing economic development of the SMEs and thereby of the society as a whole and efforts should be made to facilitate policy outcomes on a variety of dimensions. When chalking out a plan for future schemes it is important to avoid any unintended negative impact through introduction of competitive distortions which would impede the healthy growth and long term sustainability of cloud adoption. It is also essential to keep a close eye on whether the desired socio-economic objectives of cloud adoption are being achieved. This requires institutionalization of a **governing mechanism** so as to facilitate, coordinate and monitor the cloud computing ecosystem in India for faster adoption of cloud.

The recently announced 'Digital India' and National Telecom Policy (NTP' 2012) talk about cloud adoption and lay down ambitious plans as well. However,

merely mentioning about this will not help; rather the success will depend on implementation on ground, which needs focused and time bound approach. It's the objective/intention, right set of programs/initiatives and timely decision of policy makers that matter most in making a programme successful. Intention to make a **governing mechanism** work independently, political bias free objective, initiatives/programs that look beyond today and non-bureaucratic approach in making bold/timely decision can take it close to the established targets.

On the final note, it is important to state that transparent and facilitative governance is critical for faster cloud adoption. The process of such facilitation must foster innovation on all the related aspects *viz.* in technology adoption and its application, as well as in development of all the related spheres.

7.5 Way Forward

No research study is complete in itself. It always in fact paves way to future potential areas. Cloud computing being the latest and one of the biggest paradigm shifts of this generation, there is tremendous scope for further elaborate studies to get a better understanding of the deployment of this technology for achieving the desired targets. Following are some of the suggested list of related topics wherein further research work may be taken up by the researchers/organizations interested in cloud computing services and its related aspects:

- ✓ Study of institutionalization of the **governing mechanism**
- ✓ Study of legal and regulatory framework for cloud computing
- ✓ Study of quality of service parameters for IaaS, PaaS and SaaS models for inclusion in uniform record keeping procedure and for declaring to clients for comparison purpose
- ✓ Study of taxing of cloud computing and provision of tax subsidies
- ✓ Study of issues related to third party technology acquisition, data integration and integration with mobile platforms
- ✓ Study of the International best practices and their adoption to Indian conditions