

POLICY ISSUES ON CLOUD COMPUTING IN INDIA- A COMPARATIVE LANDSCAPE

***Dr. Rajat Agarwal, **Vatsal Chanana, ***Rishabh Chanana**

**Assistant Professor, Department of Management Studies,
Indian Institute of Technology, Roorkee, India*

***Student, Netaji Subhas Institute of Technology, University of Delhi, New Delhi, India*

****Student, Delhi Technological University, New Delhi, India*

ABSTRACT

Cloud computing allows business organizations to focus on their business requirements and align IT strategically through dynamic provisioning of resources and applications. Similarly, in the Government and public sector, cloud computing offers scope for reduction in cost of service delivery. For countries like India, this can be a game changer as it may bring huge savings in cost of e-governance infrastructure, which can permit the alternative usage of funds for core development activities. To ensure the adoption of cloud computing, it is imperative that a policy framework on cloud computing is finalized so that business and government organizations can reap its benefits. This paper highlights some of the key policy issues that require attention, particularly for government and public sector in India. The paper highlights key policy issues related to cloud such as data protection, data sovereignty, cloud standards, security requirements, etc. through a comparative landscape of the policies of the developed world. A strategic policy framework/roadmap for cloud in India has also been suggested

Keywords

Cloud computing; cloud policy; ICT policy; e-governance; Digital India; cloud standards

1. INTRODUCTION

Recent advances such as high computer penetration, high-speed broadband at a lower cost, 3G, 4G technology, high-efficiency servers and amendment in storage technologies, etc., along with the business needs and economic factors together have led to the engenderment of an offering called cloud computing or simply 'Cloud'. The National Telecom Policy 2012 (NTP-2012) of India aims to "take new policy initiatives to ensure rapid expansion of new services and technologies at globally competitive prices by addressing the concerns of cloud users and other stakeholders, including specific steps that need to be taken for lowering the cost of service delivery." [1]

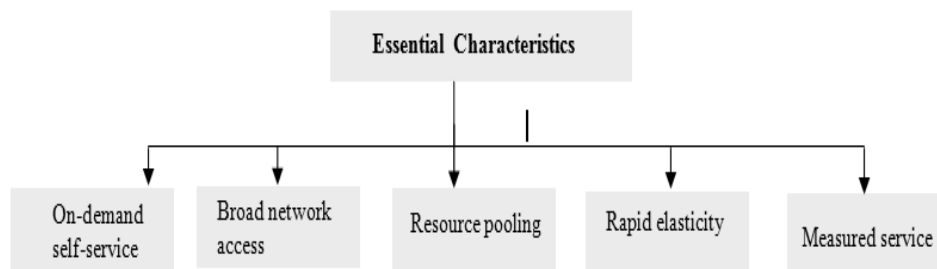
According to National Institute of Standards and Technology (NIST), USA, "Cloud computing is a model for enabling

ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." [2]

In other words, cloud refers to the sharing of hardware, development platforms and software resources over the internet on a pay-per-use or subscription basis. By leveraging the cloud a shared pool of configurable computing resources can be accessed on -demand basis. The cloud has led to a transmutation in the way in which the IT services are procured and utilized.

With the increasing competition and change in business environment, the traditional IT models, may not be able to utilize the resources efficiently and will hamper the organization development in gaining a competitive edge while requiring an immense investment. The organizations can transform their business models and acquire a competitive edge by leveraging the benefits from cloud computing adoption. The main proposal of cloud is to revamp the present IT infrastructure model from Capital Expenditure (CAPEX) model into an Operational Expenditure (OPEX) model. Along with the cost benefits, cloud computing allows an organization to focus on their core business activities while parting the task related to run IT services and infrastructure in the hands of cloud service providers (CSPs). The cloud empowers organization to establish virtual and open business processes and permitting its stakeholders (customers, business partners, suppliers, etc.) to connect and do business more efficiently [3]. Utilizing the cloud services, the governments can provide e-services more efficiently to the resident and launch e-Governance initiatives more expeditiously and likewise locally, state government and other public partners can be empowered to adopt e-Governance for providing better services to stakeholders without establishing IT infrastructure.

As per NIST, this cloud model is composed of five essential characteristics, three service models, and four deployment models.



Cloud Service Models		
<p>Software as a Service (SAAS)</p> <p>The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure.</p>	<p>Platform as a Service (PaaS)</p> <p>The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services and tools supported by the provider.</p>	<p>Infrastructure as a Service (IaaS)</p> <p>The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications.</p>

Fig 1: Cloud Essential Characteristics

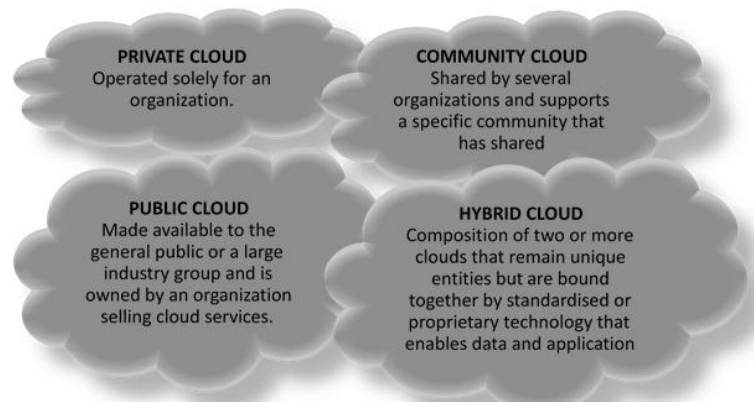


Fig 2: Cloud Service Models

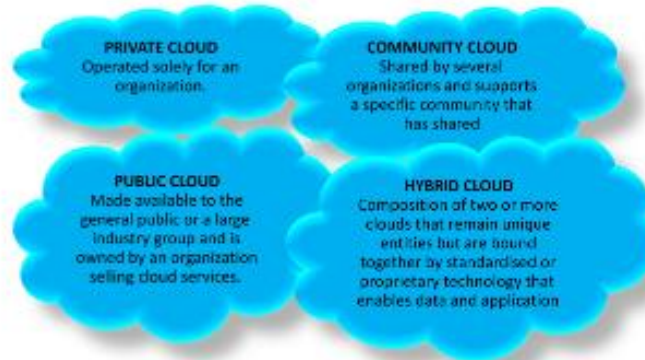


Fig 3: Cloud deployment models

With the above introduction as the base, the remaining sections of this paper are organized as follows: section 1.1 covers the cloud computing scenario in India; section 2 covers a summary of key identified issues related to cloud computing; section 3 presents a comparative summary of cloud policies in selected other countries of the world; section 4 covers the cloud initiatives in India and finally section 5 presents a strategic roadmap for enabling cloud in India and also highlights the scope for future work.

1.1 The “Cloud” of Computing in India

India with its booming economy is growing at an expeditious pace in domestic IT sector with a USD 60 Billion IT and BPO industry, thereby exhibiting enormous potential to act as a hub for distributing cloud services and also to get the benefits of cloud computing as a consumer. Cloud computing services have immense opportunity in Indian market as a large number of small and medium enterprises (SMEs) can potentially utilize reliable and scalable applications that facilitate expansion of their business at a lower technological cost.

Other areas where the cloud computing can have a sounding impact in India include sectors like education, automotive, health, Information Technology (IT) & IT enabled services (ITES) and Government. Utilizing the cloud, the government can launch e-Governance initiatives more expeditiously and with lower infrastructure and operating costs. A prevalent cloud platform will allow government bodies and partners at different level to adopt e-Governance without establishing IT infrastructure. Along with the above mentioned advantages, adoption of the cloud will provide Indian Information Technology (IT) & IT enabled services (ITES) sector an opportunity to provide cloud based services globally.

Public cloud services are accepted widely by the Indian companies as compared to the private cloud services. According to Gartner, "the spending on cloud will rise to \$ 2 billion by 2018 from \$638 million in 2014; there was an increase of almost 34 percent from 2013 to 2014". Many research reports predict enormous growth in cloud computing in India. [4] The National Association for Software and Services

Companies (NASSCOM) in association with Deloitte has recently released a study report predicting that the cloud computing market in India is projected to grow by \$16 Billion in 2020 with new businesses contributing to sixty percent of this growth. [8] A latest survey conducted by Gartner to determine the cloud adoption trends in different sectors in India reports that public cloud services are being preferred by most of the organizations in India. According to the survey 53 percent of the organizations in India are currently using cloud services, while another 43 percent are pointing plans to adopt cloud based services in coming future.

Also the revenues generated from different cloud models by 2018 are forecasted as; \$735 million from Software as a Service (SaaS), \$121 million from Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) is predicted to grow to \$295 million by 2018 in India". [4] According to IDC, "Digital data in India is projected to shoot up to 2.3 million petabytes in 2020. This slowly leads to an information explosion with cloud in the middle, as more and more Indian companies are looking to leverage the cost advantages of the cloud". [5]

2. KEY ISSUES IN ADOPTION OF CLOUD COMPUTING

A review of technical and management literature suggests that embracing the cloud by organizations to achieve improved financial and operational efficiency is still a risk-based decision rather than technology based decision. This is even more relevant for public sector wherein the assessment of risk of an IT solution is of paramount importance. Some of the key issues related to cloud computing include the following:

- *Data Security*: For the organizations migrating to the cloud unauthorized access to their data and data protection are the two main concerns which also act as a hindrance in cloud adoption. This concern primarily stems from the environment wherein their data and software are running on someone else's physical infrastructure. [3][6]
- *Interoperability and Portability*: Every cloud service provider has its own manner of providing cloud services. How cloud customers interact with their cloud vary for different service providers leading to cloud application programming interface (API) propagation. [7] In general, the interfaces and APIs of cloud accommodations are not standardized and different providers use different APIs due to which, it can be arduous to peregrinate from one cloud provider to another.
- *Service Level Agreement (SLA)*: Another key aspect to be considered by the organizations before migrating to the cloud is to obtain the required guarantees from the service provider on services that their business needs. Typically, these guarantees are provided through service level agreements (SLAs) negotiated between the providers and consumers. Constrained control of the organizations over the application on the cloud makes SLA a crucial aspect to consider while migrating to cloud.

SLA should be simple to verify easily and must cover most of the consumer expectations of addressing concerns on integrity and confidentiality of the application[3][6]

- *Reliability and Availability:* Applications migrated to cloud must be subjected to the arrangements for the disaster recovery. As modern enterprises applications are now critical, these must be reliable and available to support the smooth operations. Backup plans must work properly in the event of failure and in case of the disastrous or catastrophic failure, recovery plans must come into force with minimum disruption.[3][6]
- *Service Delivery and Billing:* Migrating to the cloud means paying for the resources used, that is an OPEX model for cost especially for the application with varying needs. Here the planning and evaluation of the expense will be troublesome until the cloud service providers have similar benchmarks to offer. So the organizations need to estimate application usage, OPEX cost and migration cost before settling on the choice to move into the Cloud. [3][6]
- *Network and Support:* With the business operations migrating to cloud, network failure is a real risk. Any failure will lead to the hindrance of the operations of the organization.
- *Change in IT Organization:* Acquiring the cloud computing services will affect the IT organization of the businesses, as has been the case with other technology shifts. Migration to cloud requires up-gradation in the skills of the IT team (especially in architecture, implementation and operation) and the migration will lead to the loss of control by IT team due to which the role of IT organization of the business may change.
- *Data Subject and Jurisdiction:* Globally, in cloud major source of the continuous tension between the cloud service providers and regulators are data sovereignty and jurisdiction. Generally, the local law of the place is applicable on the data storage. Different governments have different local laws, which are imposed on the cloud users or data providers. Lack of harmonized regulation for cloud computing can lead to a jurisdictional problem. Because of the fragmented data storage and processing, data may spread over multiple locations in different countries, which makes it difficult to trace as well as to determine which regulations will govern that data.[3][6]
- *Data Privacy:* Another big challenge that affects the cloud services is data privacy. To protect and secure the data over the cloud every country government have some data privacy law with which the service providers are expected to comply to. These laws substantially affect the foreign companies to provide the services to the consumer in different countries and hence creating a challenge for cross border cloud service providers.[3][6]

3. GLOBAL CLOUD POLICIES AND PRACTICES

One of the fundamental change that cloud computing has brought in is the removal of geographical boundaries in offering services and data transmission. Cloud service providers cater to the needs of cross-border organizations (in addition to home customers) and use service delivery methods which necessitates cross border transmission. Many countries have examined the main policy challenges on the issues highlighted in the preceding section viz., data security, data privacy, data localization, etc. associated with the cross border provision of cloud services and are making attempts to address them through domestic policies and international cooperative agreements. The continuous evolution of cloud technology has necessitated the emergence of policy environments covering the areas like data privacy, security, and cross border flow of data. In addition, many developing countries are examining their domestic infrastructure and regulatory challenges related to cloud computing. Given below are some of the policy initiatives taken by counties in different parts of the world to address the main policy requirements for cloud computing.

3.1 European Union (EU)

The European Union cloud strategy aims to evolve contract terms and conditions that cover areas like data location, data transfer, data ownership, data disclosure, data preservation, liability of cloud providers and subcontracting.

- *Standards and Certification*: The European Commission is working for the development of EU-wide voluntary cloud certification schemes. This will ensure interoperability between cloud providers. The EU is also aiming to develop a meta framework of cloud security certification schemes which compares schemes with regard to the security requirements of individual organizations.[9]
- *Code of Conduct for Cloud Service Providers*: Cloud customers must be able to trust a cloud service provider before they entrust their data and applications to them. They must ensure that personal data is handled by the cloud service provider in accordance with the EU data protection directive and its applicable national transpositions. The cloud computing strategy states that the European Commission will aim to develop a code of conduct for CSPs to support the application of data protection rules. [10]
- *Service Level Agreements (SLAs)*: The European commission is working to evolve model terms and conditions for cloud computing related service level agreements as part of the contracts between cloud providers and cloud users. In order to implement this, a subgroup on service level agreements within the cloud select industry group has been established. The EU is working on coming out with reference SLAs for cloud service providers. [11]
- *Data Privacy*: The EU favors a “baseline common level of privacy to protect the data privacy rights of Europeans regardless of where data is transferred and processed”. The EU data privacy directive

states that the transfer of personal data which is being processed from a third country may take place only if the third country ensures an adequate level of protection.

- *Data Localization:*The EU data retention directive requires service providers to retain certain identified data for all communications for 6–24 months. The purpose is that these identified data may be made available to law enforcement agencies. A reformed EU's data protection regime by the European Commission in 2012 named as the General Data Protection Regulation (GDPR) aimed to establish a single Europe wide dataprotection law.

3.2 United States

- The United States follows a self-regulatory approach. The regulations typically cover the use of personal data in some sensitive sectors such as healthcare and financial services etc.
- In the US, there is no single, national law regulating the collection and use of personal data. Instead, a number of federal and state laws, and regulations exist and these appear to overlap.
- In the United States, the Digital Due Process initiative was created in 2010. The initiative is aimed at a clearer standard for U.S. government and law enforcement access to electronic communications and personal data.
- The US government's Cloud strategy focuses on the following:
 - High federal security requirements
 - Adopting new technologies
 - Ancillary technologies
 - Technical know how
 - IT expenditure

3.3 United Kingdom

The UK operates within the framework of the European Union, particularly with respect to the EU wide Data Protection Directive and its strong engagement in the EU Cloud strategy.

- *Data Protection and Privacy:*The UK has implemented the Data Protection Act - updated in 1998 and also a local implementation of the EU Directive 95/46/EC passed in 1995. It is administered by an independent Information Commissioner's Office (ICO) which is able to intervene in both public and private sectors based on public interest priorities. The ICO also adjudicates on freedom of information measures.
- *Data Localization and Data Security:* Although individual projects, especially individual public sector procurements, may have specific localization requirements, at the policy level, there is a clear

recognition that some sectors require specific regulators to impose data curation requirements (e.g. Banking).

- *Standardization and Data Portability*: Apart from some security-based information sharing partnerships, the UK Government supports independent standardization. As such, it drives the UK engagement in international formal standardization efforts both via the National Standards body and also through the UK delegations to ISO, IEC and ITU.

4. INDIA'S INITIATIVES TO PROMOTE CLOUD COMPUTING

Digital India, a flagship project of the current Indian Government aims to create the IT and telecom infrastructure, provide electronic delivery of services and also bring in empowerment to citizens through IT. The program aims to transform India into a knowledge economy. Consequently, there is a noteworthy open door for empowering Indian markets for quickened acceptance of Cloud Computing. There is an opportunity for the government and industry to accomplice, to drive selection of cloud in India and fabricate India as a significant center point for conveying cloud solutions. Cloud computing has also been identified as one of the thrust areas in the National IT policy. Some Key Initiatives that embody the fast appropriation and deployment of cloud computing are highlighted below

4.1 Meghraj (Government of India cloud)

For the effective delivery of e-services by leveraging the cloud computing, Department of Electronics and IT (DeitY), Government of India has launched Meghraj (GI Cloud) [12], a national cloud initiative. The initiative aims to quicken the delivery of e-services to residents through the utilization of private/community cloud environment at the central and state government level. Interoperability, pooling of scarce and underused resources, increasing standardization and integration and the spread of best practices are some of the other objectives supported by the initiative. Under the national cloud initiative an e-Governance App store is also proposed, which will host customized cloud enabled and non-cloud application that can be utilized and enabled by the different government department. Meghraj along with the support of state level cloud will provide services such as computing, storage and network infrastructure, application development and customization, backup and recovery. GI (Government of India) cloud services directory also be created which will provide a platform for cloud consumers and providers to interact and set up different service contracts according to their needs and uses.

4.2 National Informatics Centre (NIC) Cloud Computing

To leverage the cloud computing a shared computing environment is provided by National Informatics Center's cloud computing [13] to government at different levels with the main objectives of saving the delivery cost, offering need based resources to government partners and effective management of technological resources. The NIC private cloud provides high performing and specific servers to central, state and local government for secure data storage and it also support secure transaction processing of worth several billion dollars per year.

4.3 National Knowledge Network (NKN)

The National Knowledge Network [14] is a multi-gigabit pan India network which provides high speed network to all knowledge-related institutions in the country. The initiative aims to provide the highest level of availability, scalability and reliable connectivity to create an infrastructure that can scale and adapt to future requirements. Some of the main services offered by NKN are, Generic services (internet, intranet, e-mails, messaging and caching gateway), community services (shared storage, authentication and collaboration service, session initiation protocol (SIP), collaboration services) and Special services (virtual private network stitching services).

4.4 Indian Banking Community Cloud (IBCC)

IBCC [15] is the first community cloud initiative for the banking industry in the world which aims to optimize the cost while maintaining desired levels of efficiency and security". The Institute for Development and Research in Banking Technology (IDRBT) along with public and private sector banks works to develop a cloud security framework for the banking industry. The initiative will help the banks by reducing the processing time and by reducing the cost from CAPEX to OPEX.

4.5 Center for Development of Advanced Computing (CDAC) Cloud

C-DAC [16] cloud initiative aims to set up physical infrastructure and support to deploy some of the in-house cloud middleware such as SuMegha, a scientific cloud, Meghdoot provides common cloud infrastructure for storage and application and Megh-sikshak a SaaS based e-learning system for managing cloud based learning system.

5. CLOUD IN INDIA – A SUGGESTIVE ‘UMBRELLA’ FRAMEWORK

The preceding sections have established the importance of cloud for Indian industry and for the larger Digital India program, and also identified the key areas of concern with respect to cloud computing. Some of the global initiatives related to key areas have also been highlighted in those sections.

As the next step, it is important that a strategic policy roadmap be suggested to ensure availability of guidelines and strategic direction to ensure achievement of the objective of a cloud eco system for adoption by business and also ensuring the delivery of Government services on cloud.

The following suggestive strategic policy framework is proposed for a structured proliferation of cloud in Indian Government and commercial organizations:

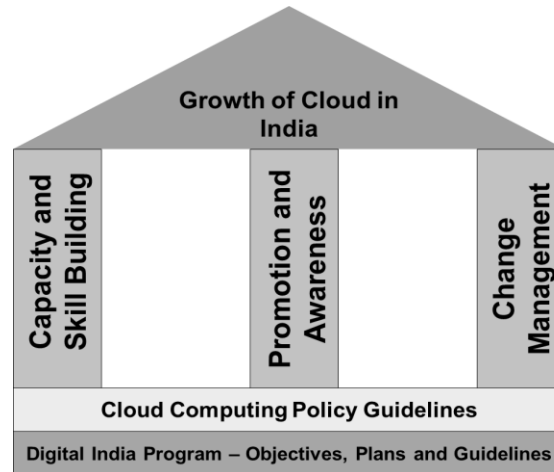


Fig 4: Suggestive strategic framework for cloud in India

- *Digital India program:* At the base or the heart of the framework is the larger Digital India program. The program is an umbrella program covering all aspects of IT in India holistically and has three pillars as given below:
 - Creation of IT Infrastructure: Broadband network and mobile access to all.
 - Electronic delivery of services: Making all Government services available online.
 - Empowerment of citizens: Electronic manufacturing, skill development, IT for jobs

The various pillars of the digital India program can actually provide the base for an overall adoption of cloud in India. The infrastructure component can facilitate the establishment of backbone for offering cloud services in India. The backbone can then be used by all types of organizations, including large and small business enterprises and also the Government. Similarly, the cloud based electronic delivery of services to citizens by the Government is expected to have a very large participation by IT industry and therefore lead to a larger cloud proliferation in the country. The ‘empowerment’ pillar can bring in the required skill for cloud computing.

- *Cloud Policy Guidelines:* The Government of India and Indian IT industry will need to work collaboratively to bring out India specific guidelines on various issues related to cloud in India. At the minimum, these include the following:
 - Code of conduct for cloud service providers
 - Model contracting guidelines with cloud Service providers including the service level agreements
 - Data privacy and access to data by government agencies

- Data localization
- Development of meta security standards framework for Indian conditions
- Cloud taxation policies
- Data protection
- Standardization and data portability

The above two foundational elements of the framework, i.e. digital India program management and cloud guidelines can be supported by the three implementation pillars as given below:

- *Promotion*: There is a big potential for awareness creation, particularly in the small business on the advantages of cloud. A joint industry-government awareness plan can actually help drive the demand for cloud based services.
- *Capacity Building*: The Indian IT and ITES industry will need a huge skill base to serve the growing demand for the same. Accordingly, a planned capacity building program with cloud as the key component may help achieve the same.
- *Change Management*: A structured change management initiative on migration of existing applications and infrastructure to cloud can help increased proliferations.

5.1 Suggestions for Future Work

Based on the study above, the following can be taken up as future areas for research/study:

- Identification of success parameters for cloud in the larger Digital India programs
- Guidelines on key issues related to cloud in India
- Framework for the promotion and awareness plan on cloud in India
- Structure of the capacity building for cloud in India
- Change management framework for migration to cloud for Indian organizations

6. REFERENCES

- [1] *National Telecom Policy 2012*, Ministry of Communication & IT, Department of Telecommunication, New Delhi, 2012
- [2] Peter, M. and Timothy G., "*The NIST Definition of Cloud Computing*", U.S. Department of Commerce, 2011
- [3] Chandejit, B., "*The Indian Cloud Revolution*", Confederation of Indian Industry, 2012
- [4] Gartner, <http://www.gartner.com/newsroom/id/2869417>

- [5] N. Venkateswaran, A STUDY ON EXPOSURE TOWARDS CLOUD COMPUTING IN INDIA, *International Journal of Development Research*, Vol. 4, Issue, 6, pp. 1308-1311, June, 2014
- [6] Nitin, K., "*The Cloud- Changing the Business Ecosystem*", KPMG,2011
- [7] Cloud API Propagation and the Race to Zero (Cloud Interoperability),<http://www.elasticvapor.com/2009/01/cloud-APIpropagation-and-race-to-zero.html>
- [8] *Deconstructing the "Cloud": The New Growth Frontier for Indian IT-BPO Sector*, NASSCOM,[http://www.nasscom.in/deconstructing-"cloud"new-growth-frontier-indian-itbpo-sector](http://www.nasscom.in/deconstructing-)
- [9] European union Agency for Network and Information Security, <https://resilience.enisa.europa.eu/cloud-computing-certification>
- [10] European commission, <https://ec.europa.eu/digital-agenda/en/cloud-select-industry-group-code-conduct>
- [11] European commission, <https://ec.europa.eu/digital-agenda/en/news/cloud-service-level-agreement-standardisation-guidelines>
- [12] GI Cloud Initiative (Meghraj,)<http://deity.gov.in/content/gi-cloud-initiative-meghraj>
- [13] NIC Cloud, <https://cloud.gov.in/>
- [14] National Knowledge Network, www.nkn.in/
- [15] Institute for Development and Research in Banking Technology, www.idrbt.ac.in/ibcc.html
- [16] CDAC http://cdac.in/index.aspx?id=cloud_si_cloud_computing