

# Cloud and E-Commerce Adoption

## Trends and Challenges in Pakistan

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**Abstract**—Cloud computing springs from prior researches on distributed computing, virtualization mechanisms, inter-networking, and software services. Cloud, as service oriented architecture, offers flexibility in the procurement of hardware and software services to cloud customers. It also substantially minimizes the capital and operation cost of maintaining huge data centers and server farms at user end. In our researches we at length debated on the trends, opportunities, and challenges of cloud computing in Pakistan. The usage of cloud computing is still at embryonic stage in Pakistan. Computerized information processing facilities at public and private organizations consume days for the provision of services which would be idyllically provided within a single day. Most services related to basic civic amenities have still to find their way on cloud. For this reason vital public information cannot be shared amongst stakeholders.

**Keywords**—cloud adoption; cloud computing

### I. INTRODUCTION

Cloud computing relies upon storage, management, and retrieval of data and applications from remote servers in clouds, instead of proprietary server farms. With rising trend in cloud adoption among enterprises, the excessive investments are pouring in cloud infrastructure. Cloud computing is combination of distributed, grid, and parallel computing with the basic purpose to provide easier access to data and services to users. It gains popularity among all magnitudes of enterprises but chiefly with smaller and medium scale ones owing to inherent benefits like reduced capital and operational cost, flexibility, and efficiency as compared to traditional legacy systems [1]. Enterprises are endeavoring to unite their legacy storage system with clouds to maneuver traditional data and applications gathering over years of operations.

Worldwide cloud market is anticipated to increase at compound annual growth rate of 36 percent through 2016. US based IT research firm Gartner's published a report<sup>1</sup> on the adoption of public cloud computing supporting this trend. According to this report, there is an impressive inflow of investment in cloud infrastructure in previous decade and aggregate investment is surmised to surpass US 200 billion dollars bench mark in 2016. It estimates that 60 percent of gross spending on cloud computing comes from North American zone. The share of Asia Pacific region is only 1.2 percent.

Cloud computing presents new dimension to small and medium enterprises (SME) by offering data and application storage, manipulation, and retrieval services at lower cost [2]. According to survey conducted by American based business intelligence research organization Aberdeen Group<sup>2</sup>, cloud adoption is more popular among SME as compared to large-scale organizations due to their limited resources. Instead of installing and managing proprietary data center and storage area networks, SME opted for viable solution to migrate their applications and data over cheaper cloud datacenters on pay-as-you-go basis.

In 2010 Aberdeen Group<sup>2</sup> surveyed approximately 100 entities to learn about their cloud adoption trends and what benefit they were materializing regarding data backup and disaster recovery. According to their findings 38 percent of small-scale and 48 percent of medium-scale enterprises have relocated their IT infrastructure over clouds for backup and disaster recovery. As compared to them only 26 percent

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<sup>1</sup> [www.gartner.com](http://www.gartner.com)

<sup>2</sup> [www.aberdeen.com/](http://www.aberdeen.com/)

of large-scale enterprises showed preference for cloud adoption because they owned proprietary multiple storage facilities and therefore found little requirement of cloud computing for disaster recovery management.

## II. EMERGING TRENDS OF CLOUD ADOPTION IN PAKISTAN

Public and private sector enterprises in Pakistan recognize potential of cloud adoption to restructure their business. Since potential of cloud computing in Pakistan is still unexplored, there is big incentive for cloud providers to fill the gap between demand and supply of cloud services. Pakistan offers profitable marketplace for cloud providers. There is a revolution in approach the way people interrelate and correspond with each other with the advent of Internet and cloud computing technology in twentieth century. As environment and people vary greatly with the course of time, education must be responsive to new effects to embrace this paradigm shift in the technological landscape [3]. Pakistan is endeavoring to manipulate cloud computing for extending literacy and higher education among masses since the inception of National Literacy Program in 2002 in collaboration with UNESCO. A pilot program has validated the efficiency of pushing mass literacy drive using cell phone text messaging capability. UNESCO<sup>3</sup> has started a Mobile Based Post Literacy program in Pakistan which is centered on mobile technology. This program is targeting rural women, aged between 15 and 25, by keeping them interested in literacy through mobile phone.

The concept of virtual learning is getting its way to K12 education as well. Swelling number of Pakistanis is attracted towards various online educational websites. The “*Virtual Education for All*” is an indigenous Pakistani initiative which is extending the concept to the primary level. Allama Iqbal Open University (AIOU)<sup>4</sup> and Virtual University (VU)<sup>5</sup> tender distance learning programs utilizing information technology. VU has secured “Outstanding New Site Award 2012” on behalf of “Open Course Ware” website created in 2011.

Pakistan Telecom Company Limited (PTCL)<sup>6</sup>, in collaboration with Viper Technology<sup>7</sup>, renders dedicated servers, file hosting, disaster recovery, and collaboration services through its cloud. These services will be provisioned through data centers situated at Islamabad, Lahore, and Karachi. In July 2013 it concluded an agreement with AIOU for provisioning of cloud computing services comprising web space, unified collaboration

services, email, and EVO services for academia, students, and administrative staff. In September 2013 the Pakistan government has signed memorandum of understanding with PTCL to maneuver e-governance project on its cloud.

The foremost challenge for an agro-sector in Pakistan is to satisfy the demand of victuals for populace while conserving natural resources for upcoming needs. Cloud computing can aid agro-farmers to craft improved decisions by offering them with timely information that boost up decision-making process, and accordingly permitting healthier administration of natural resources [4]. Pakistan’s agriculture sector employed 43.7 percent of total labour force and in fiscal year 2013-14 it contributes 21.4 percent of gross domestic product with the annual growth of 2.1 percent.

In order to bag benefit of information technology in agro sector, Pakistan Agriculture Research Council launched a project in 2013 in collaboration with CIMMYT International Maize and Wheat Improvement Center (commonly called by its Spanish acronym for *Centro Internacional de Mejoramiento de Maíz y Trigo*)<sup>8</sup> to systematically overhaul traditional agrarian practices and mends the quality and production of horticulture, forestry, fishery, and livestock goods and services. The blending of cloud computing technology with agro-sector is crucial for the latter’s progression and therefore to harness its benefits in numerous Asian countries like Japan, Malaysia, Singapore, and Korea have shown inclination to adopt cloud technology in their agro sectors. To amalgamate cloud technology and agro-sector a Japanese IT-based company Fujitsu Limited<sup>9</sup> commenced rendering cloud services through its data centers at Japan, Singapore, Australia, Germany, United Kingdom, and United States to the agro-farmers. It launched Akisai cloud for food and agricultural industries in July 2012 to maintain centralized repository of soil fertility, temperature, humidity, and rainfall of agrarian farms by manipulating SaaS based agricultural management solutions. The consumers of the Akisai could input crop’s related data through computing devices such as smart phones and retrieve information about profitability, expenditures, agro-statistics, and weather conditions linked with cultivated crops.

Emulating Akisai cloud, USAID<sup>10</sup> in association with the provincial government of Khyber Pakhtunkhwa (KPK) and Telenor, a global mobile network operator, shaped and carried out tailored mobile solutions to convey information to potato and peach agro-growers as well as fisheries within Swat Valley. By distributing real-time information about bazaar prices and innovative techniques, weather forecasting, and varied financial services through mobile

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<sup>3</sup> [www.unesco.org.pk](http://www.unesco.org.pk)

<sup>4</sup> [www.aiou.edu.pk](http://www.aiou.edu.pk)

<sup>5</sup> [www.vu.edu.pk/](http://www.vu.edu.pk/)

<sup>6</sup> [www.ptcl.com.pk](http://www.ptcl.com.pk)

<sup>7</sup> [www.viper.pk](http://www.viper.pk)

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<sup>8</sup> [www.cimmyt.org](http://www.cimmyt.org)

<sup>9</sup> [www.fujitsu.com](http://www.fujitsu.com)

<sup>10</sup> [www.usaid.gov](http://www.usaid.gov)

technology, this service aids farmers and hatchery owners to improve productivity and get superior returns on their agro-investments. As their revenue surges through informed decision making, they are able to finance in superior quality inputs and equipment. Around 1500 agro-farmers and people are integrated in pilot project, which is concentrated on testing and scaling up what needs to guarantee that the program's digital development tools to satiate participant's needs.

The project delivers two elementary services. Firstly, it delivers alarms and alerts on cellular phones to convey farmers the agro-tips in their local language, facilitating them to surge the quality and quantity of their production. Participants can also use their mobile phones to retrieve documented advisories from an interactive voice response (IVR). In a country where literacy rate is low, voice-based services mitigate the difficulties confronted by those incapable to read or write. These services deliver extensive range of information. Weather forecasting assist agro-farmers and hatchery owners to decide when to cultivate, irrigate, fruitage or harvest. Statistics on market prices and consumer trends support them to understand which agrarian merchandises will yield highest returns for their labours. Farmers also get technical information on how to bout pests or diseases, mend farming practices for sustainable agriculture, and apply techniques to reduce food wastage. They can learn about government regulations, existing subsidies and local carnivals related to agro farming. Preliminary feedback from pilot project is encouraging and approximately 90 percent of the participants who acknowledged messages alleged that those messages were timely and useful, and 66 percent of them have embraced the recommended practices. Subscribers also stated that they also communicate data with non-subscriber farmers, emphasizing the worth of the data and multiplying the project's extent. As upshot to project, mobile phone financial services like wise mobile banking, remittances, and crop insurance are also introduced. This will assist to lift food production, livelihoods, and incomes and also introduce technical solutions to improve efficacy in the agrarian supply chain.

By scrutinizing calls which farmers directed to IVR, the agro specialists and research-based groups can form a precise picture of embryonic trends in Pakistan's agricultural sector. At its pivot, mobile husbandry is about placing agro-data into farmers' hands and empowering them through workable and mountable solutions. The optimism is that the realization of this corporation will inspire and facilitate other private sector actors to move into the market, contributing to the educated and affluent agro-farming community throughout the country. It is forecasted that these modernizations will generate new economic openings, where financial strength is an indispensable factor in the region's inclusive resilience.

The provincial government of Punjab is also installing smart phone applications to scrutinize field-duties of public officials. It is now mandatory for public servants to send his or her photograph along with report of interaction with people and GPS coordinates. For instance, an agro-based pest control public employee who is obligatory to visit agro-farmers must put forward his or her finding's report in real time via smart phone application.

An effort is also going on for the digitization of land record utilizing cloud computing. Government of Punjab commenced automation of Land Records<sup>11</sup> with main objectives to augment service delivery.

A Project Management Unit has been formed under management control of Board of Revenue. The Land Record Management Information System will assist the citizens to check and confirm their land holdings on their personal computers just by loading their computerized national identity card (CNIC) number.

Financial services institutes exhibited a noteworthy attractiveness for the adoption of cloud and green computing environments for managing requirements of multifaceted business practices and systems. [5] The financial and banking sector is money-maker for any economy. In Pakistan, the banking and financial segment encompasses various monetary sectors such as corporate banking, investment banking, private banking, commodity trading, foreign exchange trading, trading in equity, and insurance. Banks are engaged in vibrant role for economic progression of Pakistan. Cloud technology is imparting windfall to voluminous segments of Pakistan's economy including banking sectors. Nevertheless banks predominantly exploit proprietary hardware and software infrastructure to store and retrieve data and contrivance financial management system. But they are inherently reluctant to embrace cloud computing for security concerns. Impediments like conflicting public regulations across transnational boundaries also hindering the adoption of cloud computing among banking sector.

Owing to contemporary cloud implementation trends, banks apprehend benefits which originate with the adoption of cloud computing. National Bank of Pakistan (NBP)<sup>12</sup> lately consolidates its 13 decentralized IBM i-Series servers, located at numerous cities countrywide, to its headquarters' IBM power-7 series centralized server. It succors unremitting availability of IT resources and disaster recovery management at various sites. Hence it satiates the State Bank of Pakistan's mandatory requirement for every bank to establish and manage disaster recovery sites.

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<sup>11</sup> <http://lrma.punjab-zameen.gov.pk>

<sup>12</sup> [www.nbp.com.pk](http://www.nbp.com.pk)

Business Continuity & Recovery Services extended services to NBP comprising data center and storage facilities beside technical support, management and administration of IT infrastructure.

Business dexterity is of critical value to petroleum and chemical industry, particularly in swift reaction to identify and swap real-time data and statistics. From IT standpoint, the budding delivery models like cloud computing tender the likelihood to fabricate the expandable infrastructure and computing outline, thus facilitating petroleum and chemical ventures to spotlight their core expertise [6]. Pakistan Petroleum Limited (PPL)<sup>13</sup> accomplished milestone as a pioneer company amid public and private organizations to deploy multisite Microsoft private cloud for its disaster recovery data centers. With the cloud in place the quantity of physical server infrastructure constraint drastically dropped from 45 to 14 servers bringing down server maintenance cost by 50 percent. To commence business systems from disaster recovery location, presently PPL consumes only 20 minutes as compared to 9 hours required before cloud migration.

Energy-saving becomes chief research topics within mobile and cloud computing sphere. Lately, an energy saving reports has been published which deals with energy saving within the mobile cloud computing. [7] To harness the benefit of cloud computing in energy sector, the provincial government of Punjab inaugurated Automated Meter Reading (AMR) project<sup>14</sup> with the technical and financial assistance of USAID. Its major objective is to diminish power theft which accounts for 20 to 30 percent of total power generated in Punjab. It will deliver precise electronic meter readings with slight human intermediation, applying technology to transfer meter readings statistics via Radio Frequency and GSM/GPRS. It is anticipated to aid power distribution companies (DISCOs) to scan electric consumption tendencies of diverse consumer categories, appreciate demand patterns, decrease electricity losses, and burgeon revenues. Preliminary AMR pilots stipulate noteworthy fall in power theft within Lahore zone. Along with automatic meter reading facility, smart meters have been mounted on feeders at all nine public-owned electricity utilities. It will help the power distribution companies in strategic planning and engineering to install smart national grid for improved generation, transmission, and distribution of electricity in country.

Cloud Computing is a multipurpose paradigm that can shore up wide-ranging applications. Its dynamic scaling and low cost turn it into a modernization driver for small and medium scale companies, predominantly in developing states. Cloud based supply chain management, enterprise resource planning, and customer relationship management

<sup>13</sup> [www.ppl.com.pk](http://www.ppl.com.pk)

<sup>14</sup> [www.cateringequipment.tendertiger.com/](http://www.cateringequipment.tendertiger.com/)

have probability to touch multitude of users [8]. Punjab Information & Technology Board (PITB)<sup>15</sup>, in partnership with Delta Tech<sup>16</sup>, scheduled “Cloud Computing Summit 2013” in April 2013 at Arfa Software Technology Park, Lahore to fabricate awareness regarding potentials of cloud computing in Pakistan. The summit endeavor to illustrate cloud prospective in various brackets – government cloud, telecom cloud, SME cloud, and mobile cloud. It cumulates stakeholders from diverse domains such as entrepreneurs, academia, government, industry, proletariat, and regulatory bodies to realize objectives:

- To fabricate cloud computing awareness as a viable business model.
- To scrutinize in vogue regional and global trends in cloud services.
- To appreciate advantages and challenges of cloud acceptance in Pakistan.
- To share successful case studies correlated to cloud adoption in Pakistan.
- To recommend procedures for the acceleration of cloud computing adoption.

### III. EMERGING TRENDS OF CLOUD COMPUTING IN PAKISTAN

Microsoft in collaboration with Fujitsu scheduled Private Cloud Immersion<sup>17</sup> session at Karachi in April 2013 to constitute awareness about the significance of cloud’s innovative technology for seamless business development and management. This facility is now fully operational at Microsoft’s workplace at Karachi. Besides Microsoft several other cloud providers have commenced their services in Pakistan with varied capabilities. For instance cloud servers operated by Massaf Web Solutions hosted into UK/2 cloud<sup>18</sup>, exploits Citrix Xen technology by allocating multiple nodes into distinct virtual machines. Every virtual server can execute its own complete operating system, and can be autonomously rebooted, customized, and reinstalled. All clientele are given complete control of their VPS through "root", VPS control panel, and virtual KVM (console) access. Another cloud provider Rana Technologies exploits Microsoft Azure platform<sup>19</sup> to provide scalable, cost-effective, and dependable cloud services. Being part of Microsoft Certified Gold Partner, they own a team of Microsoft specialists who are apt in top-notch Microsoft technologies. Their exhaustive understanding of core experience and Microsoft technologies supports them to provide cohesive, de bout en bouthosting solutions. In Sep 2013 Oracle Pakistan

<sup>15</sup> [www.pitb.gov.pk](http://www.pitb.gov.pk)

<sup>16</sup> [deltatechglobal.com](http://deltatechglobal.com)

<sup>17</sup> [www.etechn crunch.com](http://www.etechn crunch.com)

<sup>18</sup> [www.massaf.com](http://www.massaf.com)

<sup>19</sup> [www.ranatech.com](http://www.ranatech.com)

announced broad availability of Oracle Database 12/C<sup>20</sup>, the first database aimed for cloud. It passes to consumer's novel multi-tenant architecture which streamlines the practice of consolidating databases onto cloud; qualifying consumers to cope with numerous databases as unique one without any need to altercate their applications. It also bargains supplementary proficiencies of cloud computing like simplified cloning, provisioning, and resource prioritization without employing prime application changes. It also introduces an all-encompassing beta program with Oracle's consumers and partners.

#### IV. CONCLUSION

The slender research has been done in past about the bearing of cloud computing technology on developing economy of Pakistan. It is therefore need of time to coordinate elaborate research on the impact of cloud computing over diverse economic sectors. It is established that any surge in the usage of cloud computing will mark Pakistan's economy more competitive and attract inordinate investments in broadband networks. With the commencement of cloud computing, businessmen and general public will become more empowered to harness powerful applications by using computing devices and smart phones to cater their needs. Though there are copious benefits of adopting cloud computing, but problems interrelated with security and privacy of data that must have been properly addressed. Pakistan's economy is vibrant for adopting cloud computing as demonstrated by the fact that multitude of cloud service providers have started providing their services in healthy competitive environment.

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<sup>20</sup> www.oracle.com